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MILITARY HANDBOOKS
EDITED BY
COLONEL C. B. BRACKENBURY

FIELD ARTILLERY

MAJOR SISSON. C. PRATT R.A.

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MILITARY HANDBOOKS FOR OFFICERS AND NON-COMMISSIONED OFFICERS

VOL. III.

FIELD ARTILLERY

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FIELD ARTILLERY

ITS

EQUIPMENT, ORGANISATION, AND TACTICS

BY

MAJOR SISSON. C. PRATT, R.A.

PROFESSOR OF MILITARY HISTORY AT THE ROYAL MILITARY ACADEMY

WITH TWELVE PLATES

BEING THE THIRD VOLUME OF

Military Handbooks for Officers & Non-commissioned Officers

EDITED BY

COLONEL C. B. BRACKENBURY, R.A.

LATE SUPERINTENDING OFFICER OF GARRISON INSTRUCTION

LONDON
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1883

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PREFACE.

A VERY CURIOUS and widely spread feeling against the tactical value of Field Artillery prevails in the British Army, and in that Army alone. To trace its origin would not be difficult, but the task is unnecessary and useless, because there are signs that the prejudice is beginning to disappear.

The object of this book, which has been prepared with great care by an officer who is at once a technical Artillerist and a master of Modern Tactics, is to place in the hands of the English Army and Reserve Forces a handbook to which they can turn for information on the nature of Field Artillery, and its legitimate use in combination with other troops. The necessity for such knowledge can hardly be doubted, if we consider that a moment is likely to come in every action when the full power of the whole force must be used in order to strike a decisive blow. Artillery should, in the various stages of a fight, prepare the way for the other arms, support them during the whole combat, and act with vigour and self-sacrifice beside them during the final struggle at close quarters. It must know how to take up the first burden of pursuit by its fire, while the successful infantry are re-forming their ranks, disorganised by the assault. Finally, in case of repulse, it must sacrifice itself with courage and devotion to save the fortunes of the day, and restore heart and hope to the defeated troops. These important functions cannot be fulfilled if Field Artillery hangs back, and only exchanges long shots with the enemy. But the guns will never be used with decision by commanders unacquainted with the nature and power of the Arm.

The maxims given in this volume are derived from the results of late wars on the Continent, as related by the actors. One great principle underlies all precepts worth reading on the action of Field Artillery. It is that while Artillery must, like other arms, expect to have eggs broken in the making of omelettes, neither loss of men nor of guns is to be shirked in striving for the one great end—the success of the engagement. The trophies of battle will remain in the hands of the victor, and the only dishonourable manner of losing guns is in submitting to their capture after the battle has been lost because the Artillery was not sufficiently bold and energetic. English Artillery may always be trusted to be forward enough, provided it be not held back by false ideas of duty, based on a system of tactics the vitality of which has passed away with the weapons for which it was devised.

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FIELD ARTILLERY.

CHAPTER I.

THE GUN.

The modern gun—Description of parts—Material for ordnance—Construction of field gun—Length of bore—Calibre—Windage—Twist of rifling—Grooves—Vent—Powder chamber—Object of rifling—Systems of rifling — Muzzle- *versus* breech-loaders — Systems of breech-loading—Guns of the future.

The term Field Artillery is applied to that portion of the artillery arm which, under ordinary circumstances, accompanies a military force on active service.

It comprises Horse and Field Artillery batteries, mountain batteries and guns of position, all of which can combine with the cavalry and infantry of an army in effective action on the battle-field.

When fortresses or strongly entrenched positions have to be taken, a regular *siege train* or collection of guns, howitzers, and mortars of varying sizes are attached to an army. The military operations in the case of a siege have, however, a distinctive character of their own, and are carried out in their main features by the artillery and engineer arms alone, the infantry and cavalry being only used in the battles or attacks incident on the peculiar nature of the warfare. Siege artillery of a heavy type is not sufficiently mobile to be able to accompany a force in field operations, and hence it is generally not included in the term Field Artillery.

Batteries may be divided into two distinct portions :

1. The *matériel*, comprising the gun, its ammunition, carriages, and stores.

2. The *personnel*, or the men to work the battery and the horses to draw the carriages.

For the sake of simplicity it will be best to describe briefly first the *matériel* and *personnel* of an ordinary field battery, and then point out the differences which exist between various kinds of the lighter batteries.

As a battery consists of a certain number of guns, each forming a unit complete in itself, the gun and its equipment (usually called a subdivision) will first be described.

The modern gun.—A gun is simply a tube of metal closed at one end and open at the other, from which a projectile can be thrown to a considerable distance by the explosive effect of gunpowder in the bore.

In the construction of a field gun certain general principles must be observed. There must be sufficient strength to ensure perfect safety to those working the gun.[1] The bore must be made of a material capable of withstanding the wear and tear of a large number of rounds. The total weight should be as small as possible consistent with strength and the work to be done. The material should be arranged so that there should be no waste of power, and so that every part should perform its due share in withstanding the pressure from within.

When a loaded gun is fired, the conversion of the solid grains of powder into a large volume of gas causes great pressure to take place in every direction at the seat of the charge. As the powder is enclosed on all sides, the effect of the explosion will be to eject the projectile out of the bore, as a comparatively small resistance is offered by it.

As soon as the shot begins to move in the bore it leaves more space for the gas, and the pressure inside is lessened, and continues to decrease as the projectile approaches the muzzle. The powder chamber or rear part of a gun has consequently to be made stronger than the muzzle end, and all guns are, accordingly, more or less conical in form.

The pressure in the bore will vary with the amount of resistance to be overcome in throwing out the projectile, and with the quality of the powder. In a rifled gun (such as all modern field guns) the projectile is elongated, and therefore heavier in weight than the round shot of a small bore; and, moreover, it is forced to travel in a spiral course through the bore instead of rolling straight out. Hence guns of the modern type have to be made exceptionally strong about the breech.

Parts of a gun.—The muzzle-loading field guns hitherto in our service are made of a tube of steel over which, for the purpose of strengthening the powder chamber, is shrunk a *breech coil* of wrought iron. (Pl. 1.)

The different parts of a gun are the *cascable*, or projection in rear (A B).

The *breech* (B C) extends from the bottom of the bore to the neck, or small end of the cascable.

The *vent* (L) is a small channel passing through the metal of the gun from the exterior surface at top down into the bore by means of which the charge is fired.

The *trunnions* (K) are cylindrical projections on each side of the piece, by means of which it is supported on the carriage from which it is fired. They are placed a little in rear of the centre of gravity of the gun in order that it may rest steady when being worked.

The excess of weight of the portion of the gun in rear of the trunnions over that in front is termed the *preponderance.* It is desirable that this difference from a true balance should be slight, as otherwise there would be unnecessary labour in elevating and depressing the breech.

Before being able to elevate the bore of a gun to any required angle, in order to obtain increase of range for the projectile, it is necessary to obtain parallel to the axis of the bore a line which must be visible on the exterior of the piece. This is effected by raising a *dispart patch* (M) on the muzzle. In many guns (*e.g.* the 16-pounder field gun) the visual line is placed at the side of the piece, the dispart patch being raised on the trunnions.

The bore of a rifled gun has in it a certain number of *grooves* to ensure the rotation of the projectile. The distance between the grooves is called the *lands*.

The *calibre* of a gun is the diameter of the bore measured across the lands, the depth of the grooves not being reckoned.

The difference between the diameter of the bore and that of the projectile is termed *windage*.

The twist of the rifling is always reckoned in calibres. Thus a rifling of 1 in 30 calibres means that in a length in inches of 30 calibres, the grooves make one complete circuit of the bore of the gun.

In considering the construction of a gun, reference will alone be made to the ordinary field guns now in the service, viz., the 9, 13, and 16-pounder muzzle-loading guns.

Material for ordnance.—The ordinary service guns are made of an inner tube of steel and an outer jacket of wrought iron. Steel may be defined as a melted malleable alloy of iron containing a smaller proportion of carbon than exists in cast iron. It is undoubtedly far stronger in every way than wrought iron, and has been for years used in the Krupp factories as the best metal for ordnance. The steel made in England was at first found to be too uncertain in quality to be deemed safe to employ by itself. Within the last few years, however, great improvements have been made in its manufacture. By using reverberatory furnaces, which produce a very great heat, such as that of Siemens', all impurities of every kind can be burnt out of the liquid metal and a of the lighter, and probably the heavier guns, will be made of steel, as the evidence in favour of its adoption is very conclusive.[1]

Construction of gun.—The steel for the inner tube is received from the contractors in a roughly turned solid mass. If the block successfully passes its various manufacturing tests, it is roughly bored out. The tube is then heated in a furnace and plunged bodily into a bath of oil to cool. The barrel is next bored and turned to a slight extent, and then subjected to hydraulic pressure of four tons to the square inch.

The *breech-coil* or jacket forms the remaining portion of the gun, and is composed of two single coils and a trunnion ring welded together.

A coil is formed by heating a long bar of wrought-iron and twisting it round an iron roller or 'mandrel.' The mass thus formed is, when white-hot, placed under the hammer and the coils *welded* together. When the various pieces of the jacket are joined together, the hollow of the interior is turned so that its diameter is very slightly less than that of the steel tube.

The process of uniting the two portions of the gun by *shrinking* is very simple. The steel tube is placed vertically in a pit, muzzle upwards. The wrought-iron jacket is expanded by heat until it is sufficiently large to fit easily over the breech end of the tube, and is then lifted by a travelling crane and dropped over it. The steel tube is kept cool by means of water, and as the wrought-iron jacket loses its heat, it gradually contracts and firmly grips the inner tube.

A gun being thus made roughly into shape requires to have the outside and inside accurately turned, the grooves for the rifling cut, holes made for the vent and sight, &c.

The length of bore.—The bore of a gun should be sufficiently long to allow of the complete combustion of the powder. If too short a bore is used, a large quantity of the charge will be blown out of the muzzle unfired, and therefore wasted. On the other hand, by increasing the length unduly, unnecessary friction is set up between the gun and its projectile, and the velocity of the latter is lessened. Considerations, both of weight and handiness, limit also the length of the bore.

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[1] The evidence of all the leading manufacturers in England has been taken by the Experimental Committee on Ordnance, but the report is not yet *published.*

The rate of burning of the powder is obviously one of the main features in settling the question. The modern tendency is to use large charges of slow-burning powder, and hence guns are now made much longer in the bore than they used to be, in order to consume the charge. Compare, for instance, the 13 and 9-pounder guns (Pl. I.). We are now able to determine the pressure of the powder at any point in the bore, and can thus arrive theoretically at the best length for each gun, a result which is verified by actual practice.

Calibre.—The calibre of a gun depends upon the form, nature, and weight of the projectile to be used. The gun is made to suit the projectile and not the projectile to suit the gun. To throw a shot of a certain weight, owing to the shape of the projectile, obviously requires a smaller bore in a rifled than in a smooth-bore gun.

The calibre must also be made to suit the charge. As a rule a large calibre will give a greater initial velocity than a small one, and in the latter case there is some difficulty in effectively igniting a very long cartridge.

The smaller the diameter of an elongated shell of a given weight the less will be the resistance of the air, and consequently the greater the range.

The objection, however, to a very long shell is that it requires a sharp pitch in the rifling which strains the gun and the projectile, so that the walls of the shell must be made of great strength, thus reducing the internal capacity.

The more rapid the rotation of the projectile the greater will be the dispersion of bullets in case of shrapnel fire, and

Windage.—In all muzzle-loading rifled guns, windage is a necessity in order to ensure the easy loading of the piece. It has also the great advantage of allowing the flame to pass over the projectile and thus ignite a time fuse placed in its head. The main disadvantage of windage is that the rush of gas past the projectile scores and eats into the bore and gradually renders it unserviceable. This destruction of the bore is so great in the case of large powder charges, that the guns of the newest type, such as the 13-pounder muzzle-loader, have a gas-check attached to the rear of the projectile. The explosion of the charge drives forward the gas-check or plate of soft metal on to the sides of the base of the projectile, and fills up the grooves of the rifling.

As the soft metal gas-check is attached to the base of the shot, its being forced into the grooves naturally gives a rotary motion to the projectile, and it thus serves a double purpose.

Twist of rifling.—The grooves of a rifled gun are cut in the bore so as to work round it in a spiral form. By the twist is meant the inclination of the grooves from a straight line, and it is usually measured by the length in which one complete turn of the groove takes place.

The object of the rifling is to make the projectile turn round and round on its longer axis, and thus ensure that the point keeps steady and in front during its flight. The amount of twist should not be more than is just sufficient to effect this, as otherwise an undue strain will be placed on the studs or other means of taking the grooves attached to the projectile. The longer the shell and the lower its velocity the greater must be the twist. For the ordinary service projectiles which are from 2½ to 3 calibres in length a twist of from 1 in 30 to 1 in 35 calibres gives the best result. The twist may be *uniform*, such as that used in the 9 and 16-pounder guns, or it may be *increasing*, *i.e.* may commence with a very slow twist near the powder chamber and gradually become sharper towards the muzzle, as in the 13-pounder. By using an increasing twist the pressure on the studs is *decreased* by about one-half.

Grooves.—The size, shape, and number of the grooves employed depends upon the system of rifling. The strength of the gun-barrel is less affected by a number of shallow grooves than a few deep ones.

The grooves in the 9 and 16-pounder are three in number, and of the 'French modified' pattern (Pl. I.). The side o the groove against which the studs are pressed as the projectile comes out of the bore, is made with a shallow incline, so that the studs may run up it and be gradually gripped. The other side of the groove is steeply cut to facilitate loading.

The 13-pounder has ten very shallow grooves symmetrical in form, the loading and driving sides being alike. This was the system of rifling in the Armstrong field guns.

The vent.—All existing ordnance is fired by means of a friction tube, the flash from which passes down the vent hole and ignites the charge.

The position of the vent affects materially the explosion of the charge, as powder does not ignite instantaneously but gradually. From experiments made with heavy guns, it appears that the best result is produced when the cartridge is ignited at a distance of $\frac{4}{10}$ of its length from the bottom of the bore. In the 9 and 16-pounder, however, the vent is bored close to the end of the powder chamber, as the advantage is obtained that all unfired powder and remnants of cartridge are with certainty ejected from the muzzle.

In the 13-pounder, owing to the great length of the cartridge, it is necessary to ignite it near its centre, and the vent hole is pierced seven inches from the end of the bore. Smouldering remnants of the cartridge bag are in consequence frequently left in the bore, and great care has to be exercised in sponging out the gun, the more especially so as the sponge used is of very low gauge in comparison with the chamber.

the vent hole is much damaged by wear, the vent bush can be removed and replaced by a new one.

Powder chamber.—The powder chamber is that portion of the bore in which the cartridge is placed, and is not rifled, the cutting of the grooves being commenced somewhat to the front of it. In the 9 and 16-pounder guns the bore is of the same diameter throughout.

To the 13-pounder, however, an enlarged powder chamber is given, with a view to obtain increased range and effect without increasing the strain on the piece. The diameter of the cartridge being less than that of the bore, there is left round it a considerable air-space for the gas to expand in. By having this air space, we are enabled to utilise with good effect larger charges of powder than would be otherwise possible. A large charge, moreover, is enabled to be thoroughly consumed at that portion of the bore where its effect should be greatest. Another peculiarity of the 13-pounder gun is, that in front of the chamber there is a contraction of the bore or *choke* which, in conjunction with the gas-check attached to the projectile, almost entirely does away with windage. Recent experiments have shown that slow burning powders, combined with retention of the projectile at first, greatly improve the power of long guns without increasing the pressure on the interior.

Object of rifling.—The object of rifling the bore of a gun is to obtain from it increased accuracy and range, and to enable us to fire a heavy shell.

The inaccuracy of smooth-bore guns is due mainly to the varying of the powder pressure owing to loss by windage, the irregular movement of the shot in the bore, and its uncertain rotation in the air. The shot leaves the muzzle with a rotation due to the last portion of the bore it touched, and the position of its own centre of gravity, both being elements for which no constant allowance can be made.

In a rifled gun a definite and very rapid[1] rotation in a known direction is given which obviates entirely the bad effects of windage and irregularity in weight and form of the projectile. The deviation of a shell from its original direction is constant, and can, therefore, be allowed for and the accuracy of the gun increased. The rifled shell, moreover, being gripped as it were at the muzzle of the gun, issues from it point foremost in the exact direction to which the gun points.

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[1] The shell from the 16-pounder rotates about 150 times a second.

The forces which bring a fired projectile to the ground and limit the range are gravity and the resistance of the air. The first force being always constant, we need only consider the second, which is proportional to the area of the shot in section.

It is obvious that an elongated shot has a section much less than a round one of the same weight, and therefore meets with less resistance from the air, and will, with a similar muzzle velocity, range further. The front part of a rifled shell, again, may be made of a form the most favourable for passing through the air with the least resistance.

Systems of rifling.—The following are the systems of rifling now in use.

1. The gun is loaded from the breech. The projectile has a soft metal coating, or one or more rings, attached to it somewhat larger in diameter than the bore of the gun. On discharge the soft metal is forced into the grooves and thus gives rotation to the shot.

To this system belongs the Armstrong breech-loading field guns which are now kept in store, but which would probably be used if we were at any time forced to exert the whole of our military strength.

In guns of this class the projectile is perfectly centred as it leaves the bore, and the shooting is very accurate. There is a total absence of windage, and the grooves are usually numerous and shallow.

perfectly centred on leaving the muzzle. On the other hand, the windage admits of the gas igniting an ordinary time-fuse in the head of the shell.

3. The gun is either a breech or muzzle-loader. The projectile has a smooth outward surface, and is given rotation by means of a soft metal sabôt, or gas-check, attached to its base which is expanded with the grooves. To this class belong the service 13-pounder muzzle-loader and the breech-loaders now being experimented upon.

The grooves are numerous and shallow, the shot is accurately centred, there is scarcely any windage, and the strain on the gun is comparatively slight.

Muzzle versus *Breech-loaders.*—The relative advantages of breech and muzzle-loading ordnance have been much discussed, especially since the war of 1870, in which the Krupp breech-loading gun played so important a part. Curiously enough England was the first power to adopt a breech-loading system (the Armstrong) for ordnance, and then was the only one which discarded it in favour of the simpler muzzle-loading gun. It is unnecessary now to enter into the arguments hitherto held for and against the rival systems, as owing to the great strides made in gun manufacture the conditions have considerably altered.

Taking as a type for the muzzle-loader the 13-pounder gun and for a breech-loader the best gun of similar size, such as the 12½-pounder experimental Armstrong gun or the most modern French field gun, let us contrast briefly their respective merits.

The muzzle-loader is the cheapest and easiest to construct. This consideration need scarcely be weighed by a country possessing so much wealth and manufacturing ability as England.

The *power* of the gun, its accuracy, range, and rapidity of fire in the two systems may be assumed to be practically identical when using the same charge.

The projectile with its mode of ignition is in construction and effect the same. Breech-loaders can, however, be made to fire a larger charge without increasing the length of the powder chamber. Thus better effect can be obtained than from the muzzle-loader. With regard to strength and durability, the merits of the two guns are on the whole similar.

Muzzle-loaders have a great superiority in regard to simplicity of equipment and stores. However excellent a breech-loading system may be, it must consist of several parts, each of which must be carefully looked after to keep it in working order. 'This necessitates carrying to the field spare parts and complicated stores, as well as great care in the handling and service of the guns. For the equipment of an artillery like our own, when guns, ammunition, and stores must be interchangeable for and be used in such various climates as those of our widely-spread colonies and in our Indian Empire as well as for Home service, simplicity is of even greater importance than in the case of the purely Continental powers.'

While admitting the force of this argument, it may be urged on the other side that the most modern forms of closing the breech are sufficiently strong, simple, and serviceable for all practical contingencies.

The enlargement of the powder chamber in the muzzle-loading gun raises undoubtedly an element of danger which will be specially prominent in firing blank charges, in that it will be difficult to thoroughly sponge out the gun and quench the smouldering remnants of cartridge.

The unquestionable advantage of the breech-loader lies in the fact, that by using it increased safety can be procured for the gun detachment. As has been before stated, the length of guns has recently been much increased. Behind gun-pits, earth-works, or any form of cover, it is evident that a breech-loader can be served by a detachment almost wholly under cover; while if a muzzle-loading gun is used, the sponging and loading numbers must under ordinary circumstances be more exposed. Even in the open the men serving at the breech

Artillery must advance to short ranges to get the best effects, and it is now a debated question as to how protection for the gunners can be obtained. Some form of shield or mantlet will have to be carried on or with the gun-carriage, and cover so afforded could be best used in the case of a breech-loading gun.

The breech-loader, moreover, possesses over its rival certain practical advantages on active service. There is the power of unloading the gun, which may often save the unnecessary expenditure of a round of ammunition. It also permits of the readjusting of the time fuse, a point of importance in view of the increase in power of shrapnel fire. The coming into action with loaded guns, which is sometimes of advantage, can be effected more safely with a breech than a muzzle-loading system.

Again, when guns have to be fired rapidly, the loading of a muzzle-loader under the existing conditions of an enlarged powder chamber and a central vent is likely to be attended with accident.

It will be noticed that nearly all the advantages claimed for the breech-loader affect its application in the field, and consequently the majority of regimental officers with practical experience of the requirements of a mounted battery are in favour of its adoption.

Systems of breech-loading.—In all breech-loading systems the bore of the gun is simply a hollow tube, and it becomes a question as to the best method of closing one end in a manner which shall be effective both for ease in loading and safety in firing.

In the Armstrong system, which still lingers in the service, a hole is cut in the top of the bore behind the powder chamber. Into this a vent piece is dropped, the face of which closes the bore. A hollow breech-screw, which works backwards and forwards, holds the vent piece in its place when the gun is fired, and when not screwed up admits of its being taken out, and of the gun being loaded. The projectile and charge is inserted through the hollow of the breech-screw.

In the best modern system, which has already been partially adopted by us, the breech is closed by a solid breech-block swung on a hinge at the end of the bore. In order to load, the breech block is swung clear of the bore. In order to fire, the block is pushed in and kept in its place by revolving it a quarter turn, the effect of which is to make an interrupted male screw on the breech block bite into a female screw in the bore.

Guns of the future.—The power and weight of the guns of the future depend mainly on the ability to construct a carriage that shall stand the shock of recoil, and a shell that will not be too heavy to carry into the field.

It may be taken for granted (*vide* p. 26) that the weight in draught of a heavy and light gun equipment should not exceed 40 and 35 cwt. respectively. It may also be assumed (*vide* pp. 26, 27) that a carriage not materially different in weight from the present one can be made to withstand a much greater shock on discharge, and that satisfactory arrangements can be made for the conveyance of ammunition.

The present horse artillery 9-pounder gun of 6 cwt. does not appear to be too heavy for draught, while the old 9-pounder of 8 cwt. was complained of as throwing too much work on the team. One is, therefore, led to conclude that the weight of the light field gun should be about 7 cwt. The results of recent experiments tend to show that a gun of that weight can be manufactured which shall throw a shell weighing about 12 or 12½ lbs. with a muzzle velocity of some 1,700 feet per second.

Our present 16-pounder, on the other hand, is distinctly too heavy in draught, but it is believed that this can be lessened by taking 2 to 3 cwt. off the gun-carriage and its limber. This would leave us with about 12 cwt. for the metal of the gun itself. There appears no manufacturing recoil, will tend rather to decrease the weight of the shot, and it will probably not exceed some 18 lbs.

Both guns will, of course, be breech-loaders, as the opposition to a change of system in loading is now very small, and in fact the great length of the guns leaves little choice in the matter.

CHAPTER II.

THE CARRIAGE.

Essentials of a carriage—Mobility—Stability—Strength—Simplicity—Transport—The gun-carriage—Trail—Axle-tree—Trunnion holes—Elevating screw—Sponge—Handspike—Wheels—Drag-shoe—Break—Axle-tree boxes—The gun-limber—The ammunition waggon—Spare carriages—Small stores—Pole *versus* shaft draught—Weight behind teams—Carriages of the future.

THE principles which govern the construction of field artillery carriages are simple enough to understand if the nature of the work they have to perform is considered.

The chief carriages of a battery are the gun-carriage and its ammunition waggon. Each of these consists of two parts: a body which carries about two-thirds of the weight, and a limber, conveying the remaining one-third, to which the draught horses are attached.

Guns and their waggons have to accompany cavalry and infantry in their movements over all classes of ground, hence *mobility* is a first essential.

Mobility.—To ensure lightness in draught the weight of the carriage should be as small as possible consistent with strength to carry the requisite load.

The diameter of the wheels should be as large, and the axle as small as possible. The size of the wheels is limited, however, by considerations of weight, stability, convenience in working the gun, and necessity for placing carriages under

Carriages should be able to reverse in a small space. This is effected by concentrating the weight directly over the axle-trees, and attaching the two portions of a carriage together by a long and narrow trail or perch, which enables the front wheels to lock round through a considerable angle.

In order to conform to inequalities of ground without straining the connection between the limber and its body, great freedom of play is requisite in the mode of attachment. This is effected by means of an eye or hole in the point of the trail resting loosely on a hook in rear of the limber. This arrangement also admits of the two portions of the carriage being readily detached from each other, a point of great importance in the service of a gun.

Stability.—In order to prevent the carriage turning over when going over rough ground, a considerable amount of stability is requisite. This is secured by placing the wheels wide apart and keeping the weight carried as low down as possible.

The width apart of the wheels for all ordinary field carriages has been fixed at 5 ft. 2 in., a breadth of track which is only exceeded in the Russian equipment.

The bulk of the weight being placed over the axle-trees renders it impossible to have it carried as low as in an ordinary carriage, where the load can be uniformly distributed. Field carriages are, however, sufficiently stable for all practical purposes, and can with difficulty be turned over.

Strength and durability.—Strength and durability are points of much importance. The material used should be strong and light, be able to withstand the action of climate, and not deteriorate when kept in store.

Of late years wrought iron has superseded wood to a great extent in those portions of the carriage where strength is especially required. It is probable that before long steel will in turn take the place of wrought iron. English carriages are, roughly speaking, some 25 per cent. heavier than those of the Continental Powers.

Simplicity.—There should be as few varieties of carriages as possible. There should be nothing complicated nor likely to get out of order. All the parts and fittings, where practicable, should be of the same pattern and interchangeable, and should be capable of being easily repaired when damaged.

Transport.—As our field equipment is liable for service in all parts of the world, carriages must be made so that they can be readily taken to pieces and conveniently stowed on board ship.

Gun-carriage.—In addition to the ordinary strains to which a travelling carriage is subject, the gun-carriage has to withstand the destructive effect of the shock of discharge.

When placed on the ground ready to fire, the gun is supported near its centre by the trunnions resting in trunnion holes over the axle-tree of the carriage. The breach rests on an elevating screw, by means of which elevation or depression of the axis of the piece can be given.

The carriage stands on the two wheels and the point of the trail which has been lifted off the hook in rear of the limber. (Pl. II.)

When a gun is fired, the effect of the explosion will be impressed upon the carriage to which it is attached. The force of recoil may be taken to act in the line of the axis of the piece and force the carriage to the rear, a great strain is hence put on the trunnion holes and from them transferred to the axle-tree bed. As the carriage is supported on the ground by the point of the trail, there is a tendency to press it into the ground, and for the whole gun and carriage to turn over backwards. This tendency causes a 'jump,' or flying up of the muzzle, which slightly increases the proper range due to any angle of elevation, and causes a downward blow on the head of the elevating screw.

When a gun is fired at any high angle there are also severe downward strains on all parts of the carriage. In order to meet the above conditions the gun-carriage is made as strongly bolted together and meeting at the trail eye (B), which is steeled in order to prevent wear by friction on the limber hook.

A short trail checks the recoil, but has to be made stronger than a long one. It also keeps the fore and hind axles of the travelling gun-carriage close together. The trail must, however, be sufficiently long to allow of easy access between the wheels, and also to prevent any liability of the gun turning over backwards. These conditions are satisfied in the ordinary service carriage by an inclination to the ground of about 23°. In the carriages hitherto made for the 13-pounder, however, the angle is considerably greater, some 30°, the trail being very short. The jump is consequently increased, and there is a tendency for the trail to furrow into the ground.

Axle-tree.—The wrought-iron body of the carriage on which the main weight of the gun rests is termed the *axle-tree bed*, and is rigidly connected with the brackets of the trail. Connected with the sides of it are the two spindles or axle-tree arms, on which the wheels revolve. To assist in meeting the horizontal strain of recoil there are two iron stays or bars (Pl. III., E) joined to the brackets of the trail.

Trunnion holes.—The trunnions of the gun rest in two trunnion holes cut in the brackets, and are prevented from jumping out when the gun is fired by *cap squares* (C). The height of the trunnion holes above the ground should allow of the gun firing over a 3 ft. 6 in. parapet, and they should be vertically over the axis of the axle-tree. By thus placing them the weight is directly thrown on the wheels, the trail is easy to lift, and there is just sufficient weight resting on the limber hook when the carriage is travelling.

Elevating screw.—For the purpose of elevating or depressing the gun, an elevating screw (in the case of the 13-pounder an arc) (D) is attached to the cascable. By an arrangement of bevelled wheels the screw can be worked either up or down.

Sponge.—A sponge for cleaning and wiping out the bore is buckled on to the top of the trail. It is probable that, owing to the enlarged powder chambers now used, there will have to be introduced a sponge head which will mechanically expand when pressed home to the bottom of the bore and thus fit it closely.

Handspike.—In order to assist in laying a gun, a handspike is carried beside the sponge and is fitted into a socket near the end of the trail when the gun is in action; a powerful lever is thus given to enable the trail to be shifted to the right or left as required.

Wheels.—The *nave* or central portion of an ordinary field wheel is made of two gun-metal flanges, bolted together, enclosing a pipe-box or hollow tube, in which the axle-tree arm revolves.

The pipe-box is made of a hard, strong metal, called phosphor bronze, with a view of lessening the friction as much as possible between it and the wrought-iron end of the axle-tree.

Connecting the nave with the outer rim of the wheel are twelve spokes of oak. When a carriage is going over rough ground there is a strong lateral thrust given to the centre of the lower wheel. To counteract this, the wheel is 'dished,' or formed into a kind of dome, the spokes being leaned slightly outwards. (*Vide* front elevation of 16-pounder carriage, Pl. III.)

The rim of the wheel is formed of six felloes (H) (pronounced fellies) of ash, each gripping the end of two spokes. Outside the felloes is a ring *tire* of wrought iron ⅝ in. thick, which is shrunk on and materially strengthens the whole.

Wheels are kept in their place by means of a metal linchpin and washer. The latter is formed with an eye or loop, so that the hook of a drag rope can be attached to it if necessary (N).

The wheels of all field artillery carriages are of the

Break.—Excessive recoil is one of the main evils to be contended with in the most modern guns, and attempts are being made to overcome it by means of a break. In the 13-pounder equipment a break on the axles of the wheels has been tried but not with much success, it being found almost impossible to ensure equal friction being placed on each wheel.

Axle-tree boxes.—Boxes (M) are fitted over the axles by the side of the gun, and contain two rounds of ammunition. The tops of the boxes are utilised as a seat for gunners. In the 13-pounder equipment there is only a seat for men, the ammunition being carried in leather sockets attached to the trail.

The gun-limber.—The eye at the end of the trail of a gun is, for the purpose of movement, raised and placed on a hook attached to the rear of the limber or front portion of the gun-carriage (Pl. IV.). The limber hook is, for the purpose of convenience in limbering up and unlimbering, placed about the height of the axis of the wheels above the ground. The limber is a two-wheeled carriage, fitted to carry the supply of ammunition which accompanies the gun. The load depends upon the number of rounds which it is deemed absolutely necessary to be carried. It is, however, mainly limited by the fact that the total weight of the gun-carriage and its limber must not exceed the amount laid down for effective draught by the horses.

The gun-limber is similar to, and interchangeable with all field limbers. The *axle-tree bed* is somewhat deeper than that of the gun-carriage in order to allow of the attachment of the limber hook; a splinter bar (N), to take the draught, is attached to the bed by three *futchells* (M) and two stays of iron. On the top of the futchells are placed a platform-board and foot-board of wood (P) (Pl. IV.).

Over the centre of the axle are two large wooden ammunition boxes clamped with iron, and one small one. (The small ones are not carried in the 13-pounder equipment.) The large boxes are fitted for shells standing vertically, surrounding a central space in which the cartridges are placed. The small box carries fuses and tubes.

For the purposes of draught there are two ash shafts, the off one of which is made partly of wood and partly of iron. The iron end of the shaft fastens on to and forms a washer to the off wheel (R).

In the ammunition boxes issued to the new 13-pounders the rear side of the box opens, and the shell lie horizontally in trays one above another.

On the limber boxes can be carried two, and in case of emergency, three men.

The shafts and the traces (which are attached to the splinter bar) when in draught are inclined upwards at an angle of about 6°.

Ammunition waggon.—In order to carry a sufficient number of rounds to meet the exigencies of active service, each gun is provided with a waggon to follow it.

The ammunition waggon is made up of a limber, as already described, and a body attached to it by a perch or pole, the end of which fits on to the limber hook (Pl. V.).

The general construction of the body resembles that of the limber, only being longer and more substantial, as four ammunition boxes are carried instead of two. Fixed to the perch is a wheel block on which a spare field wheel is carried.

Spare carriages.—To each battery at war strength is allotted six gun-carriages, six ammunition waggons, and four spare carriages.

A *forge waggon* consists of an ordinary field limber with one long box on it carrying tools, and a body on which is placed a field forge for the purpose of shoeing horses and making good damages to the metalwork of the battery equipment.

A *store waggon* is similar in outward form to a forge waggon, but has different fittings, and carries the battery 'office,' collar-makers' tools, and spare small stores.

Store and ammunition waggon.—The store and ammunition waggon is similar in form and construction to the ordinary general service waggon, and has a waterproofed canvas cover. It carries carbines, intrenching tools, and spare stores.

Store cart.—There is also a two-wheeled store cart for supplies.

In addition to the authorised equipment there should be attached to a battery two general service waggons to carry tents and horse blankets, and ordinarily a water cart.

A battery when complete carries with it every necessary for both men and horses. Small stores, such as gimlets, clinometers, spare tangent scales, scissors, knives, &c., are strapped to the inside of the lids of the ammunition boxes.

Larger stores are carried underneath the carriage or by the sides of the boxes, such as camp kettles, water buckets, grease tins, drag ropes, axes, spades, shovels, bill-hooks, swingle-trees, picket ropes, lifting jack, &c.

The remainder of the stores carried (mainly in the spare carriages) are too numerous to mention, but include all camp equipment for men and horses, artificers' tools of all kinds, spare wheels, horseshoes, sponges, ropes, veterinary and quartermasters' stores, together with materials for repairing the general equipment.

Pole versus *shaft draught.*—In contradistinction to the practice of all Continental nations, the attachment of the horses to the gun and carriage is by means of a shaft instead of a pole. The advantages of using a shaft are that the carriages are better under control, can lock or turn round more readily, and come to the halt more quickly. In going over rough ground the play of the pole, which is necessarily somewhat free, and liable to snap or cause a jar to the horses, is avoided.

On the other hand, in stopping the carriage on going down hill, the whole weight is thrown upon one horse instead of two. The work is not equally divided among the team, the shaft horse being always kept up to his work, having additional weight to carry and receiving every jerk from the limber. With pole draught the harness is lighter and simpler. The hooking in and unhooking the horses is more quickly performed, and if a horse falls it is much easier to extricate and replace him, a point of vital importance on service. The weight of the shafts is considerably greater than that of the pole, and the necessity for a separate harness for one horse in a team appears a distinct disadvantage.

As long as large, powerful, well-fed horses are available, the shaft equipment may work well; but if all the exigencies of service be considered, the tendency of horses to break down from overwork, and the difficulty of replacing them with others of equal power, our existing arrangement does not seem the best. It is a common experience even after a field day to see a shaft horse completely exhausted while the rest of the team is comparatively fresh. In the present organisation, when the majority of batteries are underhorsed, and can only be brought up to war strength by a large addition of untrained remounts of varying type, it would seem advisable to adopt a system of draught to which all harness horses are accustomed.

From some notes of an officer [1] who has served in batteries with two systems of pole draught, it appears that the play of the pole going over rough ground does not seem to have acted prejudicially. On the other hand, it is stated that there must be of necessity some weight thrown on the pole horses' withers which is liable to make them stumble and cause falls. But against this must be placed the experience of the Continental armies which have lately made long campaigns, and continue to favour pole draught.

Draught.—The weight which can be given to a gun equipment obviously depends on the load which horses in a team can draw under service conditions. This can be calculated theoretically if we assume the *average* work and pace wanted and the tractive power of the horse. It is obvious that when such uncertain factors enter into a calculation differences in result are to be found.

From recent investigations [2] it appears that the greatest load which each horse should be called upon to draw is 618 lbs. for horse artillery, and 724 lbs. for field batteries.

All nations agree in having a light and a heavy field gun, though they equip them differently. The Germans use the light gun exclusively for horse artillery, the French, Austrians, and ourselves provide horse artillery and light field batteries with the same weapon, while the Italians do not use horse artillery at all.

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[1] Colonel Manderson, R.H.A.

[2] *Traction*, by Colonel Kemmis, R.A.

It must be remembered that, contrary to the practice of all other nations, we employ eight horses instead of six for our heavy field gun. This, however, may be looked upon as a mere makeshift. The disadvantage of eight horses in the *modern* battle-field are so great that in a future equipment the number will doubtless be reduced.

The following table of weights behind the teams will show how the matter at present stands. (No allowance made for men on the carriages.)

	Austrian	French	German	Italian	Russian	English	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	
Light field gun	3,415	3,498	3,968	2,806	3,784 4,096	3,936	(9)
Heavy ,,	4,223	4,400	4,268	4,268	4,626	4,769	(16)

The calculated weights are respectively 3,708 and 4,344 lbs. It will be seen that the English horse artillery equipment exceeds in weight that of any other nation when two gunners are mounted on limber, as the Germans carry their whole detachment mounted. The actual weight of the service equipment which *experience has proved not to be excessive*, is therefore some 5 cwt. in excess of the theoretical calculation.[1]

If it be remembered that the heavy field carriage has constantly to carry two men and very often five, it will be apparent that the weight of all the heavy equipment is in excess of Colonel Kemmis's calculations. If such be the case, what can be said of the 16-pounder, which is considerably heavier in draught than all the others.

Turning now to the new 13-pounder muzzle-loader, it should be noted that it was made for a horse artillery gun, and has been issued for trial both to horse and light field batteries.

On comparing its weight—4,228 lbs.—with either the results of theory or the practice of other nations, one is forced to conclude that it is too heavy for a horse artillery gun, and unnecessarily light for a field one. The experience of regimental officers leads us to believe that the present weight of the horse artillery equipment is not excessive, while the first 9-pounder issued, which was 2 cwt. heavier in draught than the present one, caused constant complaint.

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[1] The weight of a gunner is taken at 12 stone.

With regard to the 16-pounder eight horse equipment there is no doubt that the gun can accompany troops under service conditions, but experience has proved that with six horses the work to be done by the team is excessive, and should be reduced.

Viewing the above-mentioned arguments as a whole we are led to conclude that the weights behind the teams of a light and heavy field gun in our forthcoming battery equipment should not exceed 35 and 40 cwt. respectively.

Carriages of the future.—Reference has already been made (p. 14) to the type of gun which it is hoped before very long will replace our present equipment.

One of the first difficulties to overcome is to absorb the initial recoil in a gun-carriage not differing materially in weight from the present one. This may possibly be effected by using a hydraulic or compressed air buffer attached to the carriage.

The difficulty of carrying a sufficient number of a heavier shell into the field will probably be overcome by attaching to a battery two or three more ammunition waggons, as most Continental nations now do.

A suggestion is frequently made that two-wheeled limbers should be substituted for ammunition waggons. The great disadvantage of this is, that in going over rough ground the jar on the shaft horses would be oppressively great. The strongest argument in favour of a four-wheeled waggon is perhaps afforded by the experience of the Russians in the

There appears no reason, however, why the present waggon should not be considerably improved by using steel in its construction, adopting some kind of rough spring, and adjusting the weights more over the axles. It will probably also be necessary to reduce the height of the wheels, which will of course have the disadvantage of lowering the axis of the gun, and rendering it more difficult to fire over any cover that may exist.

NOTE.—An experimental field gun-carriage is now being tried at Shoeburyness, and appears to be a success. The initial shock of discharge is partially absorbed by a hydraulic buffer, while the recoil is checked by a very ingenious self-acting differential break attached to the axles of the wheels.

CHAPTER III.

THE AMMUNITION.

Advantages of elongated projectiles—Length and weight—Common shell, 16-pr., 9-pr., 13-pr.—Shrapnel, 16-pr., 9-pr., 13-pr.—Case shot—Fuses—15-second M.L. fuse—Mode of ignition—15-second fuse (B.L. pattern)—Mode of ignition—Percussion fuses—Mode of action—Friction tubes—Mode of firing—Cartridges—Gunpowder—Advantages of—Composition—Action—Powder used—Amount of ammunition carried—Proportion of common shell—Shrapnel—Case.

Rifled guns have now entirely superseded smooth bores in all field equipment. From them we obtain to a much greater extent the qualities desirable in all ordnance, namely, length of range, accuracy, penetration, flatness of trajectory, and destructive effect.

Elongated projectiles.—The application of rifling to the bore of guns enables us to use elongated in lieu of round projectiles, a rotatory motion being produced round the longer axis, thus enabling the shell to keep point foremost during its flight.

The advantages secured by lengthening the projectile are—

1. That for a given weight there is a diminished surface for the resistance of the air to act upon, and hence greater range.

4. The projectile may be made (within reasonable limits) of any required form or weight.

5. The capacity of the shell fired, either with regard to bullets or powder, is increased, and hence a greater destructive effect.

Projectiles vary in their exterior form according to the system of rifling in the gun which fires them. They may be either coated with soft metal, as in the case of the Armstrong breech-loader, have soft metal rings round them, as in the German equipment, have studs affixed like our own 9 and 16 pounder shell, or have a gas-check at the base, like projectiles of the most modern type.

Length and weight.—The length and weight of projectiles are governed by numerous considerations, such as the diameter of the bore, the twist of the rifling, the charge of powder, and the work to be done. A very long projectile necessitates a rapid twist in the rifling, and consequent increased strain on the gun, or the shell would turn over in its flight. Excessive weight, again, will cause undue strain to the bore, and increase the difficulties of transport of ammunition. The lowest admissible length for accuracy of shooting appears to be about two calibres, while to adopt a shell lighter than can be used with advantage, would materially reduce the destructive effect. The gun and its projectile are mutually dependent, but being given a rifled gun, the dimensions of the best projectile for it can be theoretically determined. In all cases it would appear that for any one gun the weights of the various projectiles should be approximately the same.

There are three general classes of projectiles carried with batteries in the field, namely, common and shrapnel shell, and case shot.

Common shell.—Common shell is merely a hollow cast-iron cylinder, closed at the ends and filled with powder. It may be described as either a locomotive mine destined for the destruction of material at a distance, or as a man-killing projectile when used against troops in masses or behind substantial cover.

Common shells are made to contain as large a bursting charge as possible. The sides of the shell must, however, be sufficiently strong to withstand the shock of discharge. It is desirable, also, that the shell should break up into a number of fragments of about the same weight when burst. Common shell are always painted black.

16-pounder shell.—The 16-pounder common shell has a length of about three times its diameter (Pl. VI., fig. 2), and carries a bursting charge of 1 lb. 2 oz. The head of the shell is tapered off, and the apex is provided with a fuse hole, into which can be screwed a metal percussion fuse, or inserted a wooden time fuse.

The shell is usually carried filled, the aperture at the top being closed by a gun-metal screw plug. The interior is made smooth with lacquer to prevent premature explosion arising from the friction of the bursting charge against the rough iron during transport or on discharge. Three rows of gun-metal studs are affixed to the outside of the shell by undercut grooves in order to fit into the three grooves of the gun and thus enable the shell to take the rifling. The weight when filled is 16 lbs. 3 oz.

9-pounder shell.—The 9-pounder common shell differs from the 16-pounder only in being smaller and lighter (9 lbs. 1 oz.), and having copper instead of gun-metal studs.

13-pounder shell.—The 13-pounder shell does not taper so much towards the head, and has instead of studs a gun-metal gas check affixed to the base, which is specially shaped so as to give a hold to it. The action of the powder gas, when the gun is fired, drives the rim of the gas check forward and makes it bite into the grooves of the gun, thus giving rotation. The bursting charge is only 10 oz., and the total weight of the shell 13 lbs.

Shrapnel shell.—Shrapnel shell differs from common shell in having the great bulk of its interior filled with bullets

16-pounder shrapnel.—The 16-pounder shrapnel is of the same length as the common shell, and consists of a cast-iron cylinder closed at one end. The sides of the shell are thinner than those of common shell, as they are made just sufficiently strong to withstand the shock of discharge without breaking up. At the base of the cylinder the shell contracts, forming a powder chamber. A tin cup, coned at the top to facilitate loading, fits into the powder chamber and contains the bursting charge of 1½ oz. of powder. The object of this cup is to prevent the powder working up into the shell, and thus causing premature explosion either in transport or on discharge.

Above the cup is a wrought-iron diaphragm or cone, which effectually prevents the bullets breaking into the powder chamber.

A tube of gun-metal screws into the centre of the diaphragm and forms a channel in which a primer, or tube filled with fine mealed powder, is placed. A tin socket is soldered on to the top of the gun-metal tube, and in the upper part of it is fitted a gun-metal socket for holding the fuse or plug.

To the outer sides of the cylinder are affixed the gun-metal studs to take the rifling.

The function of the head of the shell being merely to hold the fuse and penetrate the air, it is made of light material, so as not to bring the centre of gravity too far forward. The interior of the head is of wood and the exterior of thin iron, which is attached to the body of the shell by screw wire rivets. The inside is filled up with seventy-two large and fifty-six small bullets, which are secured from knocking about by melted resin being poured in among them. The size of the bullets is an important matter. The smaller they are, the closer they will pack, and the greater the number that can be put in a shell; a small bullet, however, loses its velocity very quickly, and has less disabling power. From experience it is found that for the larger sized bullets a weight of about eighteen to the pound is advisable (Pl. VI., fig. 3).

Pure lead bullets would from their weight be most suitable, but it is found that they are too soft, and a mixture of lead and antimony is used.

When the fuse in the head of the shell acts, its flash ignites the primer, which in turn sets on fire the bursting charge. The explosion of the charge blows the diaphragm and bullets forward, the lightly attached head comes off, and the shell opens.

The general idea is that the bursting charge should be just sufficient to open the shell and leave the bullets free to continue their course with the velocity due to the motion of the shell at the time of the burst.

If a shrapnel shell be burst while lying on the ground, the head, and bullets, and splinters will be found dispersed on an arc some 40 yards to the front, while the base will be blown a short distance to the rear. The bursting charge may thus be considered to have very little accelerating or disturbing effect.

Owing to the rotation of the shell at the moment of the burst the bullets have a tendency to fly outwards in the form of a cone. The angle of this cone or the spread of the bullets will naturally be greater as the velocity of the shell is less, and varies, according to circumstances, from 7 to 14 degrees.

To obtain the utmost effect from a shrapnel shell it should be burst in the air by a time fuse, as the velocity of the released bullets is increased by the force of gravity, and only retarded by the resistance of the air. If a shell is burst on graze by a percussion fuse, the bullets ascend, and their movement is checked by the effect of the graze, in addition to the other two forces.

From the above description it will be evident that the effect of shrapnel depends entirely on small bullets, and that little from the 16-pounder, except in size and weight, and consequent inferior capacity to hold bullets.

13-pounder shrapnel.—The 13-pounder shrapnel is, with a smaller diameter, slightly longer than the 16-pounder shell. In construction it is similar, but is fitted with a gas check instead of studs. It contains 116 bullets of a weight of thirty-four to the pound.

Case shot.—Case shot, formerly called canister, for all light guns is of similar construction, and consists of a tin cylinder filled with bullets, the interstices between which are filled with clay and sand.

The bullets, composed of lead and antimony, run about 16½ to the pound, and vary in numbers according to the size of the shot. The 16-pounder has 176 bullets, the 9-pounder only 110.

The body of the cylinder is in three pieces, soldered together longitudinally in order to secure greater conformity in breaking up.

The bottom is of tin, and riveted to it on the outside is a ring of wrought iron. The top is closed by a tinned iron disc, which is secured by the fringed end of the sides of the cylinder, being turned over it and soldered down.

'The making of case shot for rifle guns is not such a simple business as manufacturing them for S.B. guns. In the case of the S.B. guns all that is required is to make an envelope for the bullet which is strong enough to resist the shock of discharge without smashing up all together in the bore. It must of course in all cases be weak enough to burst and liberate its contents on leaving the gun.

'Now in the case of a rifled gun we are met at the outset by an anomaly. We want to fire a projectile from a rifled gun and yet not allow it to take the rifling. Did the case leave the bore with the spin of other projectiles the dispersion of the bullets laterally would be very great, and their direct range to the front very small. In fact, for firing case shot we want to use the rifled gun as a smooth-bore. Then in the case of rifled guns we must, as much as possible, guard against injury to the bore, and yet insure the case breaking up properly on leaving the gun. In fact, the case shot must be strong enough in its construction (1) not to set up on discharge so as to take the rifling, and (2) not to be easily injured in travelling, or the ordinary knocking about unavoidable on service; while it must be weak enough, as before mentioned, to release its contents on leaving the gun.

'These considerations are obviously conflicting, and, as in so many similar cases, it is a question of hitting the proper mean.

'It must be recollected that the weight of the envelope and of the expedients used to strengthen it, as well as that of the packing in which the balls are placed, are necessary evils. The actual useful part of the projectile is the assemblage of balls within the case.

'In the old S.B. case the envelope averaged about one-ninth the weight of the projectile; in the case for rifled guns the envelope and accessories amount to nearly as much as the weight of the balls.

'Case shot is essentially a close quarter projectile,'[1] and its effect much depends on the ricochet of the bullets. Ordinary field case is, under favourable circumstances, effective up to 400 yards.

Fuses.—In order to explode a shell at a given moment, it is necessary to have some means of igniting the powder charge. This is effected by means of fuses, of which there are three classes.

1. Time fuses, which are ignited by the shock or flame of the discharging powder, and which are arranged so as to communicate their fire to the bursting charge after a certain number of seconds. The exact interval during which the fuse has to burn before exploding the shell must be known at the time of loading the gun, and the fuse is bored or set accordingly before being inserted into a shell.

there is little doubt that a fuse of this type will be eventually introduced.

The time fuses used with the 9 and 16-pounder are the 5, 9, and 15 second fuses, the two former of which are being gradually replaced by the latter.

15 *seconds M.L. fuse.*—The 15 seconds M.L. fuse (Pl. VII.) consists of an outer case or body made of beechwood of a conical form. The fuse composition, which burns at the rate of one inch in 7½ seconds is inserted in a central channel bored out to within a short distance of the bottom or small end of the fuse. Above the fuse composition is a pellet of mealed powder, with a hole bored down its centre for the purpose of ensuring ignition. The top of the fuse is closed with a gun-metal plug holding a copper pin projecting downwards. Round the copper pin is twisted some quickmatch, which is led through two diagonally bored fireholes to a groove outside the head of the fuse. There are six powder channels bored at equal distances and parallel to the central composition channel. These channels are connected at bottom by an annular groove into which quickmatch is pressed. Holes can be bored from the outside into the powder channels in such a manner as to be able to pierce into, by means of an auger, the fuse composition at distances corresponding to one quarter of a second of time. The holes are covered with varnished paper and numbered. The bottom hole of one channel is bored through into the fuse composition, so that ignition is eventually ensured if the fuse does not act at the proper time.

Mode of ignition.—To prepare a time fuse for use, bore with a gimlet or auger a side hole into the fuse composition corresponding to the number of quarter-seconds the fuse is wanted to burn. Unscrew the metal plug on the top of the shell, insert the bored fuse, and drive it home with a smart tap from a mallet. Before ramming home the shell into the gun, tear off the tape covering the quickmatch at the top of the fuse. When the gun is fired, the flash of the charge ignites the quickmatch, which sets fire to the mealed powder and fuse composition. The latter burns down steadily till the hole which has been bored into it is reached, when the flame bursts into the powder chamber channel and thence at once down into the shell, setting off the bursting charge.

In the event of the boring of the fuse having been improperly done, the ultimate explosion of the shell is ensured by the last of the powder holes being connected with the bottom of the composition.

The object of the powder channels is not self-evident, but they are necessary (1) to ensure ignition when a side hole is in contact with the metal of the shell; (2) to enable more accurate subdivision of the fuse composition to be made; and (3) because without them the flash from the fuse composition would be insufficient to ensure the ignition of the bursting charge.

In the event of a shell striking head on to a hard substance the time fuse will generally be driven into it and act instantaneously.

13-*pounder fuse.*—Owing to the almost entire absence of windage in the 13-pounder gun, caused by using a gas check, a detonating arrangement has to be used in the head of the fuse to ensure the lighting of the quickmatch.

A cylinder of an alloy resembling gun-metal is screwed into the head of the fuse. This cylinder contains a hammer suspended by a light copper wire, and below the hammer is placed detonating composition. A hole is bored through the bottom of the cylinder to allow the flash of the detonator to pass through to the quickmatch. A safety-pin passes through the head of the fuse between the hammer and the detonating composition, which must be removed before the fuse is used.

The exterior of the fuse head has copper wire wound round it to prevent it splitting.

Mode of ignition.—Just before placing the shell in the gun the safety-pin is pulled out. The shock of the discharge ing in the air after a ricochet, the effect on troops would be very small. The body of the ordinary percussion fuse is of gun-metal, made so as to screw into the socket at the head of the shell.

In the centre of the top is a steel needle, A. A metal collar, called the guard, B, fits next the top through two holes in which a safety-pin of twisted brass wire runs. Resting on the bottom of the body is a hollow lead pellet, C, the flanges of which support the guard in position. The top of the pellet is hollowed out and contains detonating composition, and the central channel of the pellet and a recess it leads to is filled up with fine powder. When the safety-pin is withdrawn, the hole through which it passes might allow of a flash passing into the fuse and thus prematurely exploding it. To prevent this, a small lead pellet is placed in a side hole, D, and as soon as the safety-pin is withdrawn, drops over the safety-pin hole. (Pl. VII., fig. 2.)

Action of fuse.—Just prior to loading the safety-pin is withdrawn. The shock of discharge breaks off the lead flanges of the central pellet, thus allowing the *guard* to slip back to the rear of the fuse. As soon as the progress of the shell is checked by impact on anything, both guard and pellet together fly forward, driving the detonating composition on to the steel needle. The flash thus caused ignites the priming of the fuse, and blowing out the thin plate at the bottom of it communicates fire to the bursting charge of the shell.

Friction tubes.—The friction tube, which provides a safe and handy method of igniting the charge of a gun, consists of a copper barrel about 3 inches long and $\frac{2}{10}$ inch in diameter. It is lacquered inside and driven with mealed powder, which is pierced by a central hole. The top of the tube is closed with shellac putty and the bottom with varnished paper. Near the top of the tube a hole is bored in which is inserted a short cylindrical piece of tubing called the *nib-piece.* Inside the *nib-piece* is inserted a copper friction bar, roughened at one end, and with a small piece of detonating composition placed *above and* below it. The projecting portion of the friction bar is formed into an eye. The edges of the end of the *nib-piece* are pinched together so as to firmly hold the friction bar. The tubes are packed in hermetically sealed tin cylinders, each holding twenty-five.

Mode of firing.—The tube to be fired is inserted in the vent of the gun, while the lanyard (a piece of cord with a hook attached) is hooked on to the eye-piece. A strong steady pull at this lanyard draws out the friction bar, ignites the detonating composition, and thus sets fire to the mealed powder in the tube, causing the flash to pierce the cartridge. The gas from the exploded cartridge drives the tube out of the vent.

Cartridges.—The powder which has to be fired from a gun is enclosed in a bag called a cartridge, which ensures safety, rapidity, and convenience in loading. The cartridge should be strong enough to bear reasonable knocking about, and be close enough in texture to prevent the powder working out. On the other hand, it should admit of the flash from the friction tube getting readily through it, and when fired no smouldering fragments of the envelope should be left in the bore of the gun. Hitherto, white serge has been used for making bags, but it is being gradually replaced by a material of stronger texture called silkcloth.

The end of the cartridge is closed or choked, and it is bound round in two or three places with braid.

The cartridge must have a diameter sensibly less than that of the bore of the gun to facilitate loading. For the 9 and 16 pounder guns its length is approximately that of the projectile.

The 13-pounder cartridge is very long, some 15⅓ inches, owing to the largeness of the charge (3⅛ lb.) used in a small bore. The principle of air-spacing or enlarging a chamber at the base of the bore, and allowing the gas greater cubic space to expand in, admits of an exceptionally high charge

1. A maximum of propelling force with a minimum of initial pressure in the bore of the gun.
2. Uniformity of action.
3. Freedom from fouling.
4. Durability, being able to bear transport and to keep well in store.

Of all explosive substances at present known, gunpowder alone can be said to fulfil the whole of these conditions. Its advantages may be summed up as follows:

(*a*) The rate of combustion is gradual, and both by adjusting the proportion of the ingredients and varying the process of manufacture, its explosiveness can be modified so as to suit every gun.

(*b*) The ingredients are cheap and easily procured.

(*c*) The powder is safe to make and keeps well, both in store and transport, if not exposed to damp.

Composition.—Gunpowder is an intimate mixture of saltpetre, sulphur, and charcoal, of which three ingredients in varying proportions it has always been made since its introduction, five centuries ago. English Government powder contains by weight 75 per cent. of saltpetre, 15 of charcoal, and 10 of sulphur.

Variations in the process of manufacture exert even more influence on its action than slight changes in the constituents, and one of the main difficulties in powder factories is to produce at different times identically the same powder. Considerable progress has of late years been made in the manufacture of gunpowder, especially in that used for heavy ordnance. By altering the size, shape, and density of the grains, control is obtained over combustion, and we are now enabled to expel a projectile at a very high velocity from a gun with a comparatively low pressure on the bore.

Exhaustive experiments are now being carried on with a view of diminishing a great existing evil—the erosion of the bore, and it may be confidently anticipated that before long the useful effect of powder will be largely increased. The explosive effect of gunpowder depends (irrespective of *air-spacing)* mainly on its density, hardness, size and shape *of grain*, and glazing.

As an illustration of the effect of one of the most important of these factors an experiment which took place some years ago may be quoted.

A small cake of powder, 1·06 oz. in weight, was placed in a mortar and a light ball placed upon it. When fired the ball was not thrown out. By breaking the cake into twelve pieces the ball was sent 10 feet; by breaking it into fifty pieces the range was 32 feet; while with the same weight of ordinary powder, 170 feet was covered.

Action of powder.—The explosion of powder is the sudden conversion of the solid grains into gas, occupying very many times the volume of the original body, and, in addition, highly expanded by the heat generated during the transformation. The gas thus suddenly produced being confined by the metal of the gun and the loaded projectile, naturally exerts its force where there is the least resistance, and drives the projectile with violence out of the bore.

Owing to the resistance of the projectile and the sudden action of the powder, there is a pressure on the sides and bottom of the bore which necessitates a strong powder chamber and causes recoil of the gun.

Powder used.—The powder at present used in field guns is the R.L.G.$_2$ (Rifle Large Grain). The grains are compact, and about ¼ inch in diameter, and highly glazed. The old cannon powder (large grain), and service powder when it deteriorates, are used for filling shell. Shrapnel, however, requiring a sharp sudden burst, has small charges of fine grain powder. In the field guns of the future it is probable that a large charge of slow-burning powder, such as a small pebble powder, will be used.

Tests for powder.—Gunpowder is liable to deteriorate if it is not carefully looked after. Cartridges should never be allowed to become damp, and those in a battery should be

1. The grain should be firm, crisp, and black, but not too shining, leaving no mark when rubbed between the hands, and not crumbling when pinched between the nails.

2. When poured from one bowl into another from a height of two or three feet it should show an entire freedom from dust.

3. It should not be caked together.

4. When a small quantity is flashed on a piece of glass there should be little or no residue, above all, no small white specks.

5. A small quantity moistened, worked into a paste, spread on white paper and dried, should present a perfectly black and not a rusty black appearance.[1]

Ammunition carried.—The experience of war does not establish definitely the exact number of rounds which should be carried by field guns. Putting aside exceptional cases the supply should be based on the maximum amount which a battery can reasonably be expected to expend. The average number of rounds fired in any engagement is comparatively small as compared to the number fired by single batteries. To take a few instances from German experience in 1870.

	Average number of rounds fired per gun	Greatest number of rounds fired per gun
Battle of Weissemburg	15·5	33·3
„ Wœrth	42·6	202·1
„ Spicheren	30·4	85
„ Borny	20·7	52·5
Mars-la-Tour	94	230
Gravelotte	56·5	184
Beaumont	30	146
Noisseville	59·5	158
Sedan	55·8	145

At Villiers-Champigny, a Wurtemburg light fieldbattery, according to Colonel Astier, fired 245 rounds per gun. During the Russo-Turkish war the total expenditure of the heavier field batteries amounted to 163 rounds per gun, while the greatest amount of ammunition expended in a single affair, took place at the assault of Nicopolis, in which one battery fired 180 rounds per gun. It must be remembered that when an exceptionally large number of shells are fired, a certain amount of ammunition may be in general procured from the reserve columns. A glance at the following table will show that all nations carry a very large number of rounds, and it is a matter for consideration whether it would not be advantageous to reduce the number of rounds with a battery and make efficient arrangement as to bringing up a further supply in exceptional cases. If this view were adopted it would do away with the main difficulty which now exists as to the carriage of ammunition of the proposed new guns.

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[1] Knollys, *Field Artillery*.

Number of rounds carried per gun.

	England	Austria	Germany	France	Italy	Russia
Light field gun	148	152	[1] 154	[1] 160	140	[1] 165
Heavy field gun	100	128	[1] 136	[1] 138	130	[1] 126

Proportion of different ammunitions.—The English equipment differs materially from the foreign ones in having a far larger proportion of shrapnel shell.

Equipment	English			French		Austrian		German	
Nature of gun	9-pr.	16-pr.	13-pr.	8-c.	9-c.	8-c.	9-c.	8-c.	9-c.
Common shell . .	32	24	30	59	55	—	—	—	—
Ring shell . .	—	—	—	—	—	102	85	84	75
Shrapnel . .	112	72	108	55	45	36	30	36	30
Case . . .	4	4	4	2	1	8	8	4	4
Incendiary shell .	—	—	—	—	—	[redacted]	[redacted]	[redacted]	[redacted]
Total per gun [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

With regard to the actual experience of war it is well known that the Prussians employed common shell exclusively in the war of 1870, though the Bavarians had shrapnel, and that the French shrapnel fire proved very indifferent. This may fairly be attributed to the inferior character of the fuses used. In the more recent Russo-Turkish war, again, shrapnel does not appear with a few notable exceptions to much advantage. With the exception of the Russian guard the artillerymen on both sides were insufficiently trained to expect much from them, to which defect may be added the inferiority of the powder used by the Turks and the low initial velocity of the Russian guns.[1] Shrapnel has been fired with very great effect in the recent Egyptian campaign.

The introduction of this shell into Continental equipments has been gradual, and has met with a good deal of opposition. On the other hand, moved by the results of practice firing—notably at Dartmoor and Okehampton—the English have steadily adhered to carrying a very large percentage of shrapnel.

Undoubtedly the manufacture of shells and fuses has improved within the last few years, but still the same difficulties remain as to the application of shrapnel fire. The range must be known very accurately, and gun and fuse must be laid and adjusted with the greatest precision.

A fresh element has again entered into the question, viz., the greatly increased velocity of projectiles. This undoubtedly has the effect of rendering the accurate burst of a shell more difficult than ever under service conditions, and it also renders still more dangerous the firing over the heads of friendly troops. On the other hand, the increased velocity of the projectiles adds to the power of the bullets when they strike.

Reference has alone been made to shrapnel used with time fuses, but the facts, hereafter mentioned, of the increased value of shrapnel with a *percussion fuse* throw a new light on the subject. If an effective man-killing shell which acts on impact be called shrapnel, or if—as has been suggested—a time and percussion shell be combined in one, all objection to it ceases, and the proportion carried with our batteries would appear to be even smaller than is desirable.

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[1] The muzzle velocity did not exceed 1,000 ft. per second.

Case shot.—The days for the use of case are by no means past. Nearly 1,100 rounds were expended by the Russians in the war of 1877, and the employment of case in 1870 was by no means unfrequent. Our own experience would rather lead us to increase the number of rounds carried in all cases of savage warfare, but for ordinary work the present proportion may be deemed sufficient. It is probable, however, that if the theories as to the employment of horse artillery and cavalry be deemed correct (Chap. XIII.), an increasing number of rounds should be carried by batteries which have any prospect of being engaged in a purely cavalry battle. Shrapnel reversed in the gun acts like case at the shortest ranges.

CHAPTER IV.

GUNNERY.

Definitions—Laying a gun—Tangent scales—New sight—Giving elevation and deflection—Rules for laying—Finding the range—Firing on a moving object—Employment of common shell—Its effect—Employment of shrapnel—Its effect—The future shell—Employment of case—Reversed shrapnel—Comparison of accuracy—Probable rectangles—Range tables—Table of foreign guns.

BEFORE describing the manner in which the gun and its projectile do their work, it is desirable that the following simple definitions of gunnery terms should be carefully read.

The axis of the piece.—An imaginary line passing down the centre of the bore.

Axis of the trunnions.—An imaginary line passing through the centre of the trunnions at right angles to the axis of the piece.

Windage.—The difference between the diameter of the bore and that of the projectile. More strictly speaking it is the difference between the sectional area of the bore and that of the projectile, and this difference varies according to whether the sections are taken through the studs of the projectile or the grooves of the gun, or independent of them.

Calibre.—The diameter of the bore. In rifled guns it is measured across the lands, the depth of the grooves being neglected. In order to secure accuracy of fire, the axis of the projectile should coincide at the muzzle of the gun with the axis of the piece. The projectile is then said to be *centred.*

The line of sight.—An imaginary line passing through the sights of the piece and the point aimed at.

The line of fire.—The same as the line of sight in ordinary cases, but when no sights are used it is an imaginary line joining the muzzle of the gun and the object aimed at.

Angle of elevation.—The angle which the line of sight makes with the axis of the piece.

Trajectory.—The path of the shot in passing from the muzzle to the first graze.

Line of departure.—The direction in which the projectile is moving on leaving the piece ; in other words, a tangent to the trajectory at the muzzle.

Angle of departure.—The angle between the line of departure and the horizontal plane.

Jump.—When a gun is fired there is a tendency for the whole gun and carriage to turn over backwards. The lifting of the muzzle in the front gives rises to the jump, which slightly increases the calculated range.

Angle of projection.—The angle between the line of departure and the line of sight.

Angle of descent.—The angle which a tangent to the trajectory at the first point of impact makes with the horizontal plane.

Lateral deviation.—The perpendicular distance of the point of impact right or left of the vertical plane containing the line of sight.

Derivation or drift.—The bearing off to the right or left of a projectile from its original direction due to the rotation imparted by the rifling of the piece. In our service all projectiles are made to revolve from left to right, or given a right-handed rotation, which causes a drift to the right. The form of the head of a projectile affects the derivation, as a flat-headed shot with right-handed rotation drifts to the left.

Muzzle or initial velocity.—The velocity in feet per second with which a projectile leaves the piece from which it is

The principal forces acting on a projectile in motion are the *resistance of the air*, which retards its progress ; the *force of gravity*, which causes it to descend ; and *wind*, which deflects from its original direction.

A gun is laid *point blank* when the line of sight is parallel to its axis. *Point blank range* is the range due to the jump of the gun.

The following are the natures of artillery fire.

Direct fire.—Fire from guns with service charges at all angles not exceeding 15° of elevation.

Indirect or curved fire.—Fire from guns with reduced charges and from howitzers and mortars at all angles of elevation not exceeding 15°.

High angle fire.—Fire from guns, howitzers, and mortars at all angles of elevation exceeding 15°.

Frontal fire.—The line of fire perpendicular to the front of the object aimed at.

Oblique fire.—The line of fire inclined to the front of the object aimed at.

Enfilade fire.—The line of fire parallel or nearly so to the front of the object aimed at.

Reverse fire.—When the rear instead of the front of the object is aimed at.

Laying a gun.—In order that a projectile fired from a piece of ordnance may hit a certain object, it is necessary to 'lay' the gun. This operation may be divided into two distinct parts : 1st, the bringing of the axis of the piece into the *direction* of the object aimed at ; and 2nd, the elevating the muzzle of the gun in proportion to the range, so that the projectile may reach *as far* as the mark.

As the axis of a gun is not visible, it is necessary (Pl. I.) to obtain by means of the *dispart* a visual line on the exterior of the piece. The actual means used are called *sights.* The fore sight is cut in a recess in the dispart patch at the muzzle of a gun if sighted over the top, or screwed on the top of the trunnions if the sighting is at the side.

The rear sight is on the top or side of the breech, and consists of a socket into which fits a tangent scale, which can be raised from its lowest or normal position when elevation is required.

The tangent scale.—The *tangent* scale[1] for the 9 and 16 pounder guns consists of a rectangular steel bar with a gun-metal head and sliding leaf. The scale is graduated on one side to degrees, and on the other to yards, on a third side being noted proper lengths of fuse.

Reference has before been made to the constant *derivation* or drift of a rifled gun. If the axis of an English field gun were accurately laid on an object, the shot would range considerably to the right of it. To allow for this the tangent scale is made to lean over to the left at an angle suitable to the gun,[2] and thus really cause the axis to point in the first instance to the left of the mark.

The sliding leaf in the head of the scale is graduated to 30 minutes, and is used to correct any extra irregularities due to wind or other causes.

In the centre of the sliding leaf is a notch through which the line of sight is taken up to the point of the fore sight, and thence to the object aimed at.

In the 9-pounder equipment the gun is centrally sighted on the top, has two tangent scales, one for ordinary use, reading up to 5°, one for long ranges up to 12° of elevation. One muzzle fore sight only used.

In the heavy field gun the sights are at the sides, the fore sights being on the trunnions. In addition to the sliding leaf, there is a slow motion elevating nut for fine adjustment, graduated down to minutes.

13-*pounder sight.*—The 13-pounder is central sighted only, and is provided with two tangent scales, one graduated to 5° and the other to 12°. The tangent scale is made of steel with a bronze sliding leaf. Below the notch on the top of the leaf is a capped recess having in its centre a small pin-cross wires to be used in conjunction with the small eyehole for fine laying.

The first operation in laying a gun is the adjustment of the sights.

Giving elevation and deflection.—The tangent sight is raised in the socket to the required number of degrees or yards and then clamped.

Deflection, if necessary, is then given by the sliding leaf. Deflection will always be given in the direction in which you want the alteration made ; thus, if a shell falls to the right of the mark, the next shot is wanted to fall more to the left, and *left deflection* is given.

Each minute on the deflection scale causes a difference in direction of one inch in 100 yards. Hence to find the amount of deflection wanted. Reduce the estimated error to inches and divide by the number of hundreds of yards in the range. *Ex.* If a shell falls 10 feet to left of target at a range of 1,500 yards. Right deflection required $= \frac{10 \times 12}{15} = 8$ minutes.

Prior to commencing firing an approximate allowance can be made for wind, if blowing across the range. Again, if the gun is not standing on level ground it will throw its projectile to the side of the *lowest* wheel. This can be practically allowed for by multiplying the difference of level of the wheels in inches by the angle of elevation in degrees, which will give the number of minutes' deflection required.[1] *Ex.* Right gun-wheel is 5 inches lower than left, elevation being 2°. Left deflection $= 5 \times 2 = 10$ minutes.

The sights having been adjusted, the layer of the gun has to get the *line of sight* to pass from his eye through the notch on the tangent scale, by the top of the point of the fore sight on to the object aimed at.

Rules for laying.—The following general instructions should be observed in laying a gun.

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[1] To find the difference in height of the gun-wheels. Find by the clinometer the inclination of the horizontal line on the face of the muzzle of the gun. The inclination in *degrees* is equal to the height of the wheels in *inches* (Major Hime, R.A.).

1. Choose a distinct object to aim at and get a clear view of it. Lay at first rather high, and then depress on to the mark.

2. By looking over the top of the gun, get it at once shifted so as to point generally in the direction of the mark.

3. The eye should be about one foot in rear of the tangent scale, and the gun laid quickly, so as not to fatigue the sight.

4. A full sight should always be taken, *i.e.*, the apex of the fore sight should be brought so as to appear in line with the centre of the top and broadest part of the rear notch.

5. Make all corrections for inaccurate shooting at the gun by means of the tangent scale, and not by altering the aim to different sides of the target.

Finding the range.—In order to fire with effect it is necessary to know the exact range, which is found either by a range finder or by trial shots. The mode of using a range-finder is fully explained in the 'Field Artillery Exercises of 1881,' but with a complicated instrument mistakes will always be liable to arise, and occasions will often occur when from one cause or another it cannot be employed.

In firing trial shots common shell with percussion fuses should always be used, as the position of the first graze can be fairly well judged by the smoke of the bursting charge.

When the guns are in action one of the officers should, if possible, ride forward to a point some 300 yards to the front, and the same distance clear of the flank of the battery.

The tangent scale is raised to the number of yards in the range as estimated, and No. 1 gun laid and fired. If the shell falls short or over, increase or reduce by 100 yards the elevation of No. 2 gun. If this fires short or over act similarly with No. 3 gun, and so on till two consecutive shells fall over and under, and the target is found within a limit of 100 yards. A reduced correction of 50 or even 25 yards can range (*vide* p. 55). The rapidity with which the range can be found is much increased by the observations of the officer on the flank, who, if there is much error in estimating the distance, will inform the battery commander as to the amount of correction required.

Firing at a moving target.—In the ordinary combat the target fired at will often be on the move, thus rendering the estimation of the range and the effective bursting of shells a matter of difficulty. When a battery is in action the ranges to all objects in its front near which an enemy is likely to move should be taken at leisure by a range-finder. By this means an approximation to the distance at which a body of troops is moving can be made.

When the target is moving towards the guns its distance is found by trial shots similarly as before, only the elevation is increased or reduced by stages of 200 yards instead of 100. As soon as a shell is observed to fall not *too short* (within some 100 yards of the advancing front), the whole of the guns fire a round rapidly.

If infantry is being fired at each subsequent round should have its range diminished by 100 yards, if the cavalry or artillery aimed at are trotting or galloping, the tangent scale should be lowered 200 and 300 yards respectively.

When the target is moving away from the battery the range is found in a similar manner, the whole of the guns then fire a salvo at a range not *too long*, and the elevation is increased in the same ratio as before.

If a target is moving across the front of a battery the mode of procedure is the same, only the aim is taken on the head of the column if it is moving slowly, or some distance in front of it if travelling rapidly. The subsequent rounds are laid sufficiently in front to allow of the guns being fired deliberately as the object crosses the line of sight.

It is useful to remember that troops at a quick walk cover two yards, at a trot four yards, and at a gallop six yards a second.

In firing with shrapnel shell and time fuses it is difficult to estimate the exact point of burst. According as a shell is burst over or short, the next fuse is bored one hole shorter or longer, till the *nearest* burst short of the mark is found and adhered to. The shells should burst close to the ground, and if observed exploding high up in the air the elevation of the gun must be altered.

Employment of common shell.—Common shell may be used for two classes of work.

1. To destroy earthworks, buildings, and obstacles of all kinds.

2. To fire against troops at long range, in close formations or when posted under slight cover, against the matériel of batteries, and in all cases when the moral effect of a large bursting charge will be felt.

When employed for the destruction of earthworks, &c., the effect of the shell depends on its striking velocity (and consequent penetration) and the explosive force of its bursting charge. A high remaining velocity will undoubtedly be obtained from shells of the newest type, but the fact of the initial velocity being much increased, obviously necessitates a shell being made stronger than before, and having a smaller powder capacity. The new 13-pounder shell with its bursting charge of 10 oz. cannot possibly effect much.[1] Undoubtedly a heavier shell, such as we may expect soon to have of some 18 to 22 lbs. weight, will be more effective, but still the fact remains that if we consider any field shell as a locomotive mine, the amount of powder carried in it under present conditions, will have little effect against solid earthwork.

To ensure the best effect the present practice of filling shells with dusty and inferior powder should be abandoned, and powder of a fine, hard, highly glazed nature, so as to prevent caking, be used. The recent investigations into the nature of powder will probably lead to some improvements. It is doubtful, however, if sufficient effect will ever be obtained be fired by a detonator, and give some treble the effect of ordinary powder.

The defects of gun-cotton as a shell explosive are the danger of keeping it in the limbers, uncertainty in effect, and the absence of smoke on explosion, thus rendering determination of range difficult. The latter defect seems of little importance if the attack of obstacles be alone considered. There appears a wide field for the use of a somewhat slower acting explosive, to the manufacture of which there seems no insuperable difficulties.

To carry out the second class of work referred to a high velocity is required, and the shell should burst into a large number of splinters, becoming a man-killing projectile. The service common shell bursts into a few fragments of variable size, and to combine man-killing power with penetrative effect seems an impossibility. An attempt to do so was made by us in the now disused Armstrong segment shell, and several Continental nations have followed a similar plan in building up a ring or double wall shell.

To have two separate types of common shell has the disadvantage of complicating the question of ammunition, and it would seem advisable to relegate the second class of work to shrapnel—assuming, of course, that a shrapnel shell be made which shall be thoroughly effective when used with a percussion fuse.

To obtain the maximum effect of common shell of the present type against troops they should be burst close up to, or in the centre of the formation aimed at. Against guns, limbers, &c., direct hits should be made, while against obstacles the crest of the entrenchment or obstacle should be first fired at, and endeavours made to cut it down gradually from the top. Percussion fuses should always be used, and when from softness of ground or other causes such fuses are ineffective, it is better to use shrapnel or cease firing.

Shrapnel shell.—Shrapnel shell are used against men and matériel while in the open. The effect of common shell against the actual guns and carriages of artillery, experience has proved to be *slight*, while shrapnel can disable men and horses. Against cover which affords but little resistance, such as the cover from view afforded by a hedge or skirt of a wood, shrapnel is the best projectile to use. Against works or obstacles of any strength, the penetrative effect of the bullet would of course be useless. With regard to shelter trenches and light cover, the circumstances of the particular case have to be considered. If men are actually firing from the trenches and thus partially exposing themselves, shrapnel shell burst rather high and some twenty yards short of the crest would be best for direct fire, while if the fire is oblique, a shrapnel with percussion fuse might be used. In all cases, however, of light entrenching, when the actual defenders are not visible, the crest of the entrenchment should be broken down by common shell before employing shrapnel. In attacking hasty entrenchments it must be kept in mind that there nearly always will be some supporting troops in rear of them who are partially exposed, and who would be affected by a shrapnel fire, though not by one of common shell. Shrapnel is essentially a man-killing projectile, its effects against matériel being insignificant, while its power of penetration through anything but flesh and blood is practically *nil*. It depends for its effect upon the striking velocity of the balls disengaged from the shell on bursting. The destructive value of the fragments of the shell itself may be neglected and the existence of the outer envelope be looked upon as a necessary evil—necessary in that without it the bullets cannot be transported to the place where the shell bursts ; an evil, in that by its weight and bulk it lessens the usefulness of the projectile. When a shell bursts it opens and allows a large number of bullets to pursue very much the same path as the shell would have continued to take as a single projectile. The motion of the bullets is due to the velocity belonging to the shell at the moment of

The bursting charge of a shrapnel should be small, as otherwise the cone of dispersion of the bullets will be wide. With a 16-pounder the angle of the cone of dispersion of a shell burst 800 yards from the muzzle is 8°, and this gradually increases up to 14° at 3,000 yards.

The actual effect of shrapnel is dependent—

1. On the striking velocity of the bullets.
2. The height at burst above the plane.
3. The distance short of the object at which the shell explodes.

It may be assumed that in order to disable a man a shrapnel bullet should have a velocity on striking of 500 feet per second. The remaining velocity of a 16-pounder shell at 5,000 yards is 617 feet per second, while the 13-pounder throws a shell to 6,000 yards with a remaining velocity of 644 feet per second. The striking effect of the shrapnel bullet may therefore be deemed sufficient at as long a range as is ever likely to be required.

With regard to the other two points, the area covered by the cone of dispersion both as to length and breadth must be considered.

The actual limit of this area varies according to the velocity of the shell and its position when bursting. From actual practice it appears that up to 1,000 yards the best effect is produced with the 13, 16, and 9-pounder, by bursting the shell 120, 100, and 80 yards respectively short of the object. For every 1,000 yards of range beyond, twenty yards must be deducted from the above.

It is obvious that as the range increases, the angle of descent becomes greater, and consequently the amount of ground covered by the bullets is less. If the angle of descent of the shell becomes great, the bullets strike the ground at such a high angle that the ricochet is almost entirely prevented. It is generally considered that this angle should not exceed 20°. The angle of descent of the trajectory of a 13-pounder shell at 5,000 yards is 15°, and the angle of the cone of dispersion about 11°, hence the lower bullets of the shrapnel would strike the ground at an angle of 21°.

It is thus evident that the extreme limit of shrapnel fire from any field gun at present known is about 5,000 yards. Long, however, before this limit is reached, it will be impossible to observe properly the effects of the shell, and for all ordinary cases 3,000 yards may be assumed as the extreme distance at which this class of fire should be employed.

So far with regard to the employment of shrapnel shell with time fuses. A suggestion has already been made that the shrapnel of the future should act as a man-killing projectile with a percussion fuse, and replace, for the ordinary purposes of the battle-field, common shell. It appears more reasonable to have one projectile to act against troops, whether it do so by bursting in the air or on graze, than to turn the ordinary locomotive mine or common shell to a use clearly unsuited to it. The experiments made to increase the efficacy of common shell by a segmental or ring formation cannot be deemed successful, as the whole power of this projectile must in future be devoted to the overthrow of earth-works and obstacles.

On the other hand, the great increase in velocity of modern guns has tended to increase the value of shrapnel bursting on graze, even with the present admittedly imperfect projectile.

Recent experiments which took place at Okehampton in 1879 resulted in showing that the difference between time and percussion shrapnel at ordinary service ranges is very slight. As might naturally be anticipated, against troops in skirmishing order or in extended formations the time shrapnel gave the best results, while against gun-pits and shelter trenches the percussion shell had the best of it.

The experiments were too limited to draw any very not too much to expect that improvements in the shrapnel shell will give great results. What appears to be required in the shell of the future is that it should be a time shell, which will act as a percussion one invariably when it touches the ground. Both private enterprise and foreign Governments have already succeeded in making a double-acting fuse to satisfy these conditions, and it may reasonably be hoped that the Government factories will in time follow their example.

The introduction of a shell of the type thus foreshadowed would do away with all opposition to the use of shrapnel on service, and enable it to realise those results on the battle-field which have been so confidently looked for in years past.

It is probable that by using steel the outer walls of shells will be reduced in thickness, thus giving additional interior space. A side channel for igniting the bursting charge seems preferable to a central one if the manufacturing difficulties can be surmounted.

Employment of case.—The value of case shot has apparently diminished, if one is to judge by the proportion allotted to batteries. This is no doubt due to the inferiority of the present case to that used with the smooth-bore guns. Our present projectile is no doubt very defective, and cannot be reckoned on at ranges beyond 400 yards. The Austrians and Italians, however, claim to fire case with effect up to 700 yards. There seems little doubt that greater results could be obtained by increasing the weight of the bullets used, and substituting a steel for a wrought-iron covering. With a breech-loading gun, moreover, the diameter of the shot may be increased, thereby diminishing the windage and increasing the initial velocity of the bullets.

Experiments hitherto made of attaching a gas check to the rear of the projectile have not been deemed satisfactory, but there appears no reason why some arrangement corresponding to a heavy wad, either fixed or detached, might not be used to gain extra power. There does not seem any particular necessity for using case at ranges exceeding 500 yards, when shrapnel with percussion fuse would be very effective.

When case shot is not available, a reversed shrapnel shell can be used instead.

Sir W. Armstrong has recently invented a metal fuse by means of which a shrapnel shell can be burst ten yards in front of the muzzle of the gun. If this arrangement continues to prove successful a valuable auxiliary to case is found.

Comparison of accuracy.—In order to judge of the relative accuracy of different guns, it is necessary to fire from each a large number of rounds and then compare the results.

There are various methods in vogue for deciding the matter, the simplest of which is the comparison of the areas into which a certain proportion of the shot of each gun will fall.

The construction of these 'probable rectangles' is simple enough. We have first to fire a number of shots at the same elevation, and from these find the *mean range*, by dividing the sum of the ranges by the number of rounds fired. We have next to find the *mean error in range*. This is obtained by taking the differences of range of each shot from the mean range, adding them together, and dividing by the number of rounds.

By measuring right and left of the line of fire the distance of each shot, we in a similar manner arrive at the *mean lateral deviation* and *mean lateral error*. An inspection of the annexed table[1] will clearly illustrate the matter.

Having obtained for a given range the *mean error in length* and the *mean error in breadth*, multiply them each by 1·69, and the result will give the two sides of a rectangle into which 25 per cent. of the projectiles will probably fall.[2] A comparison of rectangles affords a good criterion of the relative accuracy of guns. It should be remembered that what is called the British rectangle represents the area into

No. of round	Elevation	Charge	Weight of shell	Time of flight	Range, 1st graze	Difference of each range from mean	Lateral Deviation		Lateral error		Remarks
							Left	Right	Left	Right	
1	5°	lbs.	38½	6·8	2396	9	—	9	—	·02	
2	,,	,,	,,	6·8	2386	1	—	6·4	—	·62	Mean range = 2387 yds.
3	,,	,,	,,	6·8	2375	12	—	10	—	·98	
4	,,	,,	,,	6·8	2357	30	—	7	—	2·02	
5	,,	,,	,,	6·9	2410	23	—	7·2	—	1·82	Mean error in range = 17·9
6	,,	,,	,,	6·7	2361	26	—	10·2	—	1·18	
7	,,	,,	,,	6·8	2413	26	—	9	—	·02	Lateral deviation = 9·02 right
8	,,	,,	,,	6·8	2403	16	—	7·4	—	1·62	
9	,,	,,	,,	6·9	2401	14	—	9	—	·02	Lateral error = 1·23
10	,,	,,	,,	6·8	2365	22	—	13	—	3·98	
			10)	68·1	23·867	179	—	90·2	—	12·28	Probable rectangle = (17·9 × 1·69) × (1·23 × 1·69) = 30·25 × 2·08 yds.
				6·81	2387	17·9	—	9·02	—	1·23	

TABLE

Comparative Table of Austrian, English, French,
(Corrected as far as practicable

Principal dimensions, &c.	Austrian		English			French	
	8 cm.	9 cm.	9-pounder	16-pounder	13-pr. M.L.	8 cm.	9 cm.
Calibre . . .	2·95 ins.	3·43 ins.	3 ins.	3·6 ins.	3 ins.	3·15 ins.	3·54 ins.
No. of grooves . .	24	24	3	3	10	24	26
Depth of grooves .	·049 in.	·049 in.	·11	·11	·05 in.	·019 in.	·023 in.
Length of bore from muzzle to end of chamber	70·67 ins.	71·95 ins.	66 ins.	68·4 ins.	84 ns.	83·54 ins.	82·72 ins.
Ditto in calibres .	24	21	22	19	28	26½	22¾
Diameter of powder chamber	3·11 ins.	3·58 ins.	—	—	3·15 in.	3·27 ins.	3·7 ins.
Length of ditto .	10·04 ins.	13·78 ins.	—	—	14·13 in.	16·34 ins.	17·5 ins.
Pitch of rifling .	1 in 45 cals.	1 in 45 cals.	1 in. 30 cals.	1 in 30 cals.	1 in 30 to 1 in 100	1 in 120 to 1 in 25½	1 in 113 to, 1 in 25½
Length of gun over all	76·77 ins.	81·17 ins.	74·5 ins.	78 ins.	92 in.	89·76 ins.	89·76 ins.
Weight, including breech closing apparatus	658 lbs.	1,071 lbs.	672 lbs.	1,344 lbs.	960 lbs.	935 lbs.	1,166 lbs.
Service charge of powder	2 lbs. 1 oz.	3 lbs. 5 ozs.	1 lb. 12 ozs.	3 lbs.	3 lb. 2 oz.	3 lbs. 5 ozs.	4 lbs. 3 ozs.
Ratio of ditto to weight of shell	$\frac{1}{5}$	$\frac{1}{4·2}$	$\frac{1}{5·2}$	$\frac{1}{5·4}$	$\frac{1}{4·3}$	$\frac{1}{3·7}$	$\frac{1}{4·2}$
Muzzle velocity .	1,385 feet	1,470 feet	1,391 feet	1,350 feet	1595 ft.	1,608 feet	1,492 feet
Length of common shell	—	—	7·93 ins.	10 ins.	10·6 in.	8·98 ins.	10·08 ins.
Weight of ditto filled, with fuse	—	—	9·1 lbs.	16·2 lbs.	13·4 lbs.	12·3 lbs.	17·6 lbs.
Weight of bursting charge	—	—	7·5 ozs.	18 ozs.	10 oz.	8 ozs.	9·5 ozs.
Length of double-skin ring shell	7·38 ins.	8·46 ins.	—	—	—	—	—
Weight of ditto filled, with fuse	9·5 lbs.	13·9 lbs.	—	—	—	—	—
Weight of bursting charge	4·4 ozs.	7·5 ozs.	—	—	—	—	—
Weight of shrapnel, with fuse	10·4 lbs.	15·6 lbs.	9·75 lbs.	17·9 lbs.	13·2 lbs.	12·5 lbs.*	18 lbs.
No. of balls in ditto	105	165	68	128	116	93	92
Weight of one ball .	35 to the lb.	35 to the lb.	25 at 18, [illegible]	72 at 18, [illegible]	[illegible]	[illegible]	[illegible]

A.

German, Italian, and Russian Field Guns.
up to January 1883.)

	German		Italian		Russian		
9·5 cm.	8 cm.	9 cm.	7 cm.	9 cm.	4-pr. H.A.	4-pr. F.B.	9-pounder
3·7 ins. 28 ·06 in.	3·09 ins. 24 ·049 in.	3·46 ins. 24 ·049 in.	2·95 ins. 12 ·051 in.	3·43 ins. 24 ·049 in.	3·43 ins. 24 ·049 in.	3·43 ins. 24 ·049 in.	4·19 ins. 24 ·049 in.
89·17 ins.	74·21 ins.	73·42 ins.	62·6 ins.	73·32 ins.	57·68 ins.	73·42 ins.	72·05 ins.
24	24	21	21	21½	17	21½	17⅕
4·13 in.	3·62 ins.	3·94 ins.	3·11 ins.	*	3·86 ins.	3·86 ins.	4·63 ins.
11·82 in.	9·49 ins.	9·49 ins.	12·72 ins.	14·8 ins.	7·67 ins.	6·7 ins.	10·4 ins.
—	1 in 50 cals.	1 in 50 cals.	1 in 46⅔cals.	1 in 45 cals.	1 in 36 cals.	1 in 40 cals.	1 in. 36 cals.
98·4 in.	82·67 ins.	82·67 ins.	69·5 ins.	82·67 ins.	66·9 ins.	82·6 ins.	82·6 ins.
1553 lbs.	858 lbs.	990 lbs.	650 lbs.	1,071 lbs.	802 lbs.	1,006 lbs.	1,370 lbs.
4 lbs. 10 oz.	2 lbs. 12 ozs.	3 lbs. 5 ozs.	1 lb. 14 ozs.	3 lbs. 3 ozs.	3 lbs. 0 oz.	3 lbs. 0 oz.	4 lbs. 1 oz.
$\frac{1}{5}$ 1453 ft.	$\frac{1}{4}$ 1,525 feet	$\frac{1}{4\cdot7}$ 1,456 feet	$\frac{1}{5}$ 1,381 feet	$\frac{1}{4\cdot7}$ 1,490 feet	$\frac{1}{5}$ 1,350 feet	$\frac{1}{5}$ 1,452 feet	$\frac{1}{6\cdot8}$ 1,225 feet
11·7 in.	—	—	—	—	—	—	—
23·9 lbs.	—	—	—	—	—	—	—
12·8 ozs.	—	—	—	—	—	—	—
—	7·87 ins.	8·86 ins.	7·36 ins.	8·86 ins.	8·9 ins.	8·9 ins.	11·09 ins.
—	11·2 lbs.	15·4 lbs.	9·35 lbs.	14·8 lbs.	15·1 lbs.	15·1 lbs.	27·5 lbs.
—	7·8 ozs.	9·5 ozs.	6 ozs.	7 ozs.	7 ozs.	7 ozs.	14·4 ozs.
24 lbs. 104	12·2 lbs. 123	17·9 lbs. 210	9·24 lbs. 100	14·7 lbs. 177	15·1 lbs. 165	15·1 lbs. 165	27·5 lbs. 340
—	27 to the lb.	27 to the lb.	28 to the lb.	28 to the lb.	41 to the lb.	41 to the lb.	41 to the lb.
5 oz. 24 lbs. 186 10½ to lb.	·66 oz. 11 lbs. 76 zinc 10 to the lb.	·8 oz. 16·5 lbs. 76 zinc 6 to the lb.	·46 oz. 9 lbs. 126 zinc 20 to the lb.	·6 oz. 15·7 lbs. 226 hard lead 20 to the lb.	2·5 ozs. 14·9 lbs. 102 zinc 7½ to the lb.	2·5 ozs. 14·9 lbs. 102 zinc 7½ to the lb.	3·95 ozs. 27 lbs. 171 zinc 7½ to the lb.

Table A—

Principal dimensions, &c.	Austrian		English			French	
	8 cm.	9 cm.	9-pounder	16-pounder	13-pr. M.L.	8 cm.	9 cm.
Gun-Carriages.							
Weight of gun-carriage equipped with gun	1,685 lbs.	2,283 lbs.	2,140 lbs.	2,930 lbs.‖	2240 lbs.	2,101 lbs.	2,862 lbs.
Diameter of wheel .	54 ins.	54 ins.	60 ins.	60 ins.	60 ins.	56¼ ins.	58¼ ins.
Track . . .	60½ ins.	60½ ins.	62 ins.	62 ins.	62 ins.	56½ ins.	60 ins.
Rounds carried on gun	—	—	4 case	4 case	2 case	—	—
Limbers							
Diameter of wheel .	54 ins.	54 ins.	60 ins.	60 ins.	60 ins.	56½	58½ ins.
Weight of limber, packed	1,730 lbs.	1,940 lbs.	1,796 lbs.	1,835 lbs.	1988	1,397 lbs.	1,728 lbs.
Rounds carried in limber—							
Common shell .	—	—	8	6	8	14	15
Double-skin ring shell	24	20	—	—	—	—	—
Shrapnel ditto .	12	10	28	18	26	13	10
Case . . .	4	4	—	—	2	2	1
Total . .	40	34	36	24	36	29	26
Ratio between weight of limber and weight of ammunition carried in it	2·46	2	3·43	3·35	„	2	2
Weight, complete, behind team	3,415 lbs.	4,223 lbs.	3,936 lbs.	4,769 lbs.	4228	3,498 lbs.	4,400 lbs.
Number of horses .	6	6	6	8	6	6	6
Number of men carried on gun	2	2	2	2	2	—	—
Ditto on limber .	3	3	3	3	3	3	3
Weight per horse without gunners	570 lbs.	704 lbs.	656 lbs.	596 lbs.	705	583 lbs.	733 lbs.
Number of guns in a battery	8*	8	6	6	6	6	6
Number of waggons	8	8	6	6	6	9	9
Weight of ditto (with limber)	4,287 lbs.	4,728 lbs.	4,578 lbs.	4,578 lbs.	5012	4,048 lbs.	5,038 lbs.
Number of horses .	6	6	6	6	6	6	6
Weight per horse .	713 lbs.	788 lbs.	763 lbs.	763 lbs.	835	675 lbs.	840 lbs.
Number of rounds in waggon—							
Common shell .	—	—	24	18	22	45	40
Double-skin ring shell	78	65	—	—	—	—	—
Shrapnel ditto	24	20	84	54	82	42	35
Incendiary shell .	6	5	—	—	—	—	—
Case . . .	4	4	—	—	2		—

continued.

	German		Italian		Russian		
9·5 cm.	8 cm.	9 cm.	7 cm.	9 cm.	4-pr. H.A.	4-pr. F.B.	9-pounder
3,190 lbs.	1,968 lbs.	2,168 lbs.	1,531 lbs.	2,468 lbs.	1,802 lbs.	2,114 lbs.	2,644 lbs.
55½	55 ins.	55 ins.	50 ins.	58¼ ins.	55 ins.	55 ins.	55 ins.
60 ins.	60 ins.	60 ins.	53 ins.	60¼ ins.	65 ins.	66 ins.	65 ins.
—	1 case	1 case	2 case	2 case	2 case	2 case	1 case
58½	55 ins.	55 ins.	50 ins.	58¼ ins.	55 ins.	55 ins.	55 ins.
1,848 lbs.	2,000 lbs.	2,100 lbs.	1,275 lbs.	1,800 lbs.	1,962 lbs.	1,982 lbs.	1,962 lbs.
10	—	—	—	—	—	—	—
—	24	20	20	16	12	13	7
6	12	10	16	17	15	15	9
2	2	2	2	1	3	2	2
18	38	32	40	34	30	30	18
”	2·8	2·52	1·52	2·74	2·2	2·6	3·53
5,088 lbs.	3,968 lbs.	4,268 lbs.	2,606 lbs.	4,268 lbs.	3,784 lbs.	4,096 lbs.	4,626 lbs.
6	6	6	4	6	6	6	6
—	—	2	2	2	—	2	2
—	3	3	2	3	3	3	3
829 lbs.	660 lbs.	711 lbs.	701 lbs.	711 lbs.	635 lbs.	682 lbs.	770 lbs.
6	6	6	8	8	6	8	8
9	5	8	8	8	9	12	16
5258	4,144 lbs.	4,655 lbs.	2,998 lbs.	4,686 lbs.	4,721 lbs.	4,721 lbs.	4,719 lbs.
6	6	6	4	6	6	6	6
576	690 lbs.	776 lbs.	750 lbs.	741 lbs.	787 lbs.	787 lbs.	737 lbs.
48	—	—	—	—	—	—	—
—	60	55	50	48	42	43	25
24	24	20	48	47	45	45	27
—	2	2	2	1	3	2	2
72	86	77	100	96	90	90	54
128	154	136	140	130	165	165	126

TABLE B.

Showing relative accuracy of some of the Guns described in Table A.

N.B.—50 per cent. of the shots will fall within the length or breadth given. 25 per cent. within the rectangle formed by multiplying these two dimensions together.

Range in yards	Austrian				English				French				German			
	8 cm.		9 cm.		9-pr.		16-pr.		8 cm.		9 cm.		8 cm.		9 cm.	
	Length	Breadth	Length	Breadth	Length	Breadth	Length	Breadth	Length	Breadth	Length	Breadth	Length	Breadth	Length	Breadth
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft
1,100	39	2·6	48	2·3	40·2	4·3	62·1	3	52·5	1·3	53	1·3	62·3	2·6	59	2·3
1,650	40·5	5·3	52·5	4·3	55·2	6·7	85·8	4·9	54	3·3	54·9	3·3	72·3	4·2	69	3·6
2,200	46·5	8·9	60·5	7·5	75	9·2	105·6	7	55·7	3·9	60·5	5·2	82	6·5	75·5	5·6
3,300	90·2	20	96·9	19	134	14·2	132·6	11·8	62·9	7·9	70·2	9·1	111·5	11·8	95·1	9·8

Range in yards	Italian				Russian						English new type	
	7 cm.		9 cm.		4-pr. H.A.		4-pr. F.B.		9-pr.		13-pr. M.L.	
	Length	Breadth	Length	Breadth	Length	Breadth	Length	Breadth	Length	Breadth	Length	Breadth
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
1,100	—	3·38	36	1·6	58·4	2·7	65·6	1·3	—	—	40·5	2·5
1,650	—	—	36	3·	77·1	4·9	80	2·4	—	—	58·7	3·7
2,200	87	6	42·5	5·6	81·1	78	86	4·7	—	—	75·2	4·6
3,300	111·5	11	62·3	13·5	108·8	17·4	90·2	10·8	—	—	102·6	6·1

Accuracy Table.

(16-pr. R.M.L. gun of 12 cwt.)

Range	50 per cent. of rounds should fall within		
	Length	Breadth	Height
yds.	yds.	yds.	yds.
200	4·3	0·16	0·03
400	8·3	0·34	0·13
600	12·1	0·52	0·29
800	15·7	0·71	0·53
1000	19·1	0·91	0·85
1200	22·3	1·13	1·23
1400	25·2	1·35	1·68
1600	28·0	1·58	2·20
1800	30·6	1·83	2·78
2000	33·0	2·09	3·40
2200	35·2	2·35	4·10
2400	37·2	2·62	4·85
2600	39·0	2·90	5·77
2800	40·6	3·20	6·55
3000	42·1	3·50	7·50
3200	43·5	3·80	8·54
3400	44·8	4·13	9·65
3600	46·0	4·47	10·82
3800	47·2	4·83	12·10
4000	48·4	5·22	13·54

Factor of probability			
Per cent.	Factor	Per cent.	Factor
5	0·09	55	1·12
10	0·18	60	1·25
15	0·28	65	1·39
20	0·38	70	1·54
25	0·47	75	1·71
30	0·57	80	1·90
35	0·67	85	2·13
40	0·78	90	2·44
45	0·89	95	2·91
50	1·00	100	4·00

If the height, length, and breadth of a target are required which would afford a given percentage of hits, the dimensions in the accuracy table are multiplied by the number given in the table of factors. Four times the dimensions given will give the space in which the whole of the rounds would strike. The length multiplied by the breadth will give the area in which 25 per cent. will fall; the breadth multiplied by the height gives the area of the vertical target on which 25 per cent. would strike. The dangerous zone for 6 feet in height will be found by multiplying the figures in the column of 'Slope of descent' by 2.—*See page* 428, *Handbook for Field Service*, 1878.

DESCRIPTION OF GUN.

Length	nominal	6 ft. 2·45 in.
	total	6 „ 6 „
	of bore	5 „ 8·4 „
	of rifling	4 „ 10·04 „
Preponderance		7½ lb.
Calibre		3·6 inches.

Average weight, 12 cwt. 0 qrs. 11 lbs.
Number of grooves, 3.
Twist of rifling, uniform, 1 in 30 calibres.
Vent, of hardened copper, 0·6 inch from end of bore.

CHARGES.

Service	3 lb. R.L.G. or R.L.G.[2]
Exercise	1½ lb. blank R.L.G. or L.G.

PROJECTILES.

			Weight lb.	Weight oz.
Shells	Common	empty	15	1
		filled with 1 lb. 2 oz. bursting charge	16	3
		prepared as incendiary	—	—
	Shrapnel	filled with 176 mixed bullets, 72 at 18 per lb., and 56 at 34 per lb., and 1½ oz. bursting charge	17	14½
Shot		Case, filled with 176 mixed metal balls, at 16½ per lb., clay and sand	15	3

Accuracy Table.

(13-pr. R.M.L. gun of 8 cwt.)

Range	50 per cent. of rounds should fall within		
	Length	Breadth	Height
yds.	yds.	yds.	yds.
200	0·40	0·02	0·01
400	2·85	0·19	0·04
600	6·35	0·41	0·09
800	9·45	0·60	0·18
1000	12·15	0·77	0·36
1200	14·7	0·93	0·60
1400	16·95	1·07	0·86
1600	19·05	1·20	1·20
1800	21·15	1·32	1·60
2000	23·25	1·44	2·05
2200	25·05	1·54	2·56
2400	26·85	1·64	3·14
2600	28·65	1·74	3·78
2800	30·45	1·84	4·5
3000	31·95	1·92	5·30
3200	33·45	2·00	6·18
3400	34·80	2·08	7·10
3600	36·00	2·16	8·15
3800	37·20	2·22	9·25
4000	38·40	2·28	10·40

Factor of probability			
Per cent.	Factor	Per cent.	Factor
5	0·09	55	1·12
10	0·18	60	1·25
15	0·28	65	1·39
20	0·38	70	1·54
25	0·47	75	1·71
30	0·57	80	1·90
35	0·67	85	2·13
40	0·78	90	2·44
45	0·89	95	2·91
50	1·00	100	4·00

If the height, length, and breadth of a target are required which would afford a given percentage of hits, the dimensions in the accuracy table are multiplied by the number given in the table of factors. Four times the dimensions given will give the space in which the whole of the rounds would strike. The length multiplied by the breadth will give the area in which 25 per cent. will fall; the breadth multiplied by the height gives the area of the vertical target on which 25 per cent. would strike. The dangerous zone for 6 feet in height will be found by multiplying the figures in the column of 'Slope of descent' by 2.—*See page* 428, *Handbook for Field Service*, 1878.

DESCRIPTION OF GUN.

Length	total	7 ft. 8 ins.
	bore	7 „ 0 „
	rifling	5 „ 9 „
Preponderance		nil.
Calibre		3·0 inches.
Average weight		8 cwt.

Rifling { system, modern polygroove.
twist, increasing from 1 in 100 to 1 in 30 cals. at 9 ins. from muzzle, the remaining a uniform twist of 1 in 30.

Vent, hardened copper . . 7 inches from end of bore.

Means of rotation, copper gas check without projections.

CHARGES.

Service . . . . . . 3 lb. R.L.G.[2] in shalloon cloth.

PROJECTILES.

			Weight lb. oz.
Shells	Common	empty	12 0
		filled with 10 oz. bursting charge, and gas check	13 0
	Shrapnel	filled with 116 bullets, 34 to the lb., and resin, and ¾ oz. bursting charge and gas check	13 0
Shot, case, filled with 340 mixed metal bullets, 34 to the lb.			13 7¼

Accuracy Table.

(9-pr. R.M.L. gun of 6 cwt.)

Range	50 per cent. of rounds should fall within		
	Length	Breadth	Height
yds.	yds.	yds.	yds.
200	3·5	0·22	0·10
400	6·2	0·46	0·22
600	8·5	0·72	0·40
800	10·6	1·00	0·64
1000	12·5	1·28	0·92
1200	14·3	1·57	1·29
1400	16·1	1·87	1·72
1600	17·9	2·17	2·25
1800	20·0	2·47	2·87
2000	22·4	2·77	3·60
2200	25·0	3·07	4·49
2400	27·9	3·37	5·47
2600	31·0	3·67	6·60
2800	34·4	3·97	7·80
3000	38·1	4·27	9·00
3200	42·4	4·57	10·20
3400	47·5	4·87	11·50
3600	52·7	5·22	11·80
3800	58·4	5·45	12·10
4000	64·7	5·76	12·40

Factor of probability

Per cent.	Factor	Per cent.	Factor
5	0·09	55	1·12
10	0·18	60	1·25
15	0·28	65	1·39
20	0·38	70	1·54
25	0·47	75	1·71
30	0·57	80	1·90
35	0·67	85	2·13
40	0·78	90	2·44
45	0·89	95	2·91
50	1·00	100	4·00

If the height, length, and breadth of a target are required which would afford a given percentage of hits, the dimensions in the accuracy table are multiplied by the number given in the table of factors. Four times the dimensions given will give the space in which the whole of the rounds would strike. The length multiplied by the breadth will give the area in which 25 per cent. will fall; the breadth multiplied by the height gives the area of the vertical target on which 25 per cent. would strike. The dangerous zone for 6 feet in height will be found by multiplying the figures in the column of 'Slope of descent' by 2.—*See page* 428, *Handbook for Field Service*, 1878.

DIMENSIONS OF GUN.

Weight		6 cwt.
Length	total	74·5 inches.
	of bore	66 „
Calibre		3 „
Rifling	number of grooves	3
	twist	uniform, 1 in 30 calibres.

CHARGES.

Service	1¾ lb. R.L.G. or R.L.G.^{2} powder.
Exercise	1 lb. blank R.L.G. or L.G. powder.

PROJECTILES.

			Weight	
			lb.	oz.
Shells	Common	empty	8	9½
		filled with 7·5 oz. bursting charge	9	1
		prepared as incendiary shell		
	Shrapnel	filled with 63 mixed metal bullets, 28 at 18 per lb., and 35 at 34 per lb., and 12 drams bursting charge	9	12¾
Shot		Case, filled with 110 mixed metal bullets, at 16½ per lb., clay and sand	9	12

CHAPTER V.

FORMATION, PERSONNEL, AND DRILL OF A BATTERY.

Constitution and subdivision of a battery—The major—The captain—The subalterns—Sergeants—Artificers—Gunners and drivers—Gun detachments—Horses—Harness—Parade formations—Drill terms—Officers on parade—Drill of a battery—Movements from line—Movements from column—Pace of artillery—Commands and signals—General principles of field movements—Distances on the march—Reversing in narrow roads—Going up and down hill—Accidents—Encamping and bivouacking—Frontage and depth of formations—Estimation of time—Estimation of numbers.

The battery.—The war establishment of mounted batteries is shown on the next page.

The presence of spare carriages for manœuvring purposes may be neglected.

A gun with its waggon, and all the men, horses, and stores belonging to it, is called a *subdivision*. The six subdivisions of a battery are numbered consecutively from 1 to 6.

Two subdivisions form a *division*, the three divisions being distinguished by the terms right, centre, and left.'

The combatant officers of a battery are the major, the captain, and three subalterns.

The major.—' The major of a battery is responsible for its internal management and conduct in every particular ; he is

Detail of Horse and Field Rifled Muzzle-loading Batteries.[1]

(War Establishment).

Officers and men	R.H.A.	Field	
		16-pr.	9-pr.
Officers.			
Major 1			
Captain 1			
Lieutnts. ..3			
Surgeon 1			
Vet.-Surg. ..1	7	7	7
N.C. Officers and men.			
Sergt.-Major	1	1	1
Qrm.-Sergt...	1	1	1
Sergeants....	6	6	6
Corporals....	6	6	6
Bombardiers	6	6	6
Gunners	70	87	72
Drivers......	73	76	65
Trumpeters..	2	2	2
Artificers.			
Farrier	1	1	1
Shg.-smiths..	5	4	4
Collarmakers	2	2	2
Wheelers	2	2	2
Totals..	182	201	175

Horses, saddlery, and harness.	R.H.A.	Field	
		16-pr.	9-pr.
Horses.			
Riding.			
Officers	[1]15	[1]8	[1]8
Staff-Sergts..	2	2	2
N.C. Officers	12	12	12
Farrier......	1	1	1
Shng.-smiths	3	1	1
Trumpeters..	2	2	2
Gunners	36	—	—
Spare	6	4	4
Total....	77	30	30
Draught.			
Guns........	36	48	36
Waggons. gun ammunition	36	48	36
Waggons. forge ammunition & supply	22	22	22
Spare........	12	10	8
Total horses	183	158	132
Saddlery, sets.			
Officers	—	6	6
N.C. Officers and gunners	62	22	22
Harness.			
Dble. sets. lead..	31	43	31
Dble. sets. wheel	22	21	20

Equipment	R.H.A.	Field	
		16-pr.	9-pr.
Ordnance.			
Rifled M.L. guns	6	6	6
Carriages.			
Gun	6	6	6
Waggons. ammun.	6	6	6
Waggons. forge, limber up ..	1	1	1
Waggons. ammun. & store[2]	3	3	3
Total	16	16	16
Ammunition.			
Rounds per gun........	148	100	148
Artificers' Tools.			
Collarmakers', sets 2	per battery.		
Farriers', " 2			
Smiths', " 1			
Wheeler-fitters', " 1			
Material for repairs.			
Collarmkrs', smiths', and wheelers' ..	Sufficient for 3 months		

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[1] Private property in R.H.A. Two in each field battery for veterinary surgeon.

[2] One for supplies.

paymaster and quartermaster of an infantry regiment has to be transacted in the battery office, and the important nature of his charge, and the onerous duties connected with it, place a major in a position analogous to that of a commanding officer in other branches of the service.

At large stations the disciplinary power of the major is taken from him, an anomaly that is accounted for by the existence of a large number of lieut.-colonels, for whom in time of peace it is difficult to find employment.

The captain.[1]—'The captain of a battery holds the same position in reference to the major as the major of an infantry battalion does to the lieut.-colonel in command. According to his own capabilities, and to the course of administration pursued by the major, he may be either a superfluity and nonentity, or a very valuable adjunct. Second in command of the battery, he assumes the chief direction when the major is absent, and at other times he may be a most useful channel for carrying out the orders of his commanding officer, whether as applied to subalterns or the men, and for assisting him generally in the administration of the battery. He is expected to pay particular attention to the clothing, equipment, harness, and gun stores—to the preliminary drills of the gunners and drivers, and to riding school and stable duties.' When the battery is manœuvring he dresses the line, takes up points, helps to select suitable positions, and is specially charged to look after the ammunition waggons. If a half battery is detached for any particular duty he usually takes charge of it.

The amount of matériel to be looked after and the quantity of work to be done renders it necessary to subdivide the duties in a battery, and give more individual responsibility to junior officers than is customary in other branches of the service.

horse battery there are three lieutenants, each of whom has a charge of a *division* of two guns, with the same relative authority in the barracks as on the field. They are directly responsible to the major for the general well-being of their divisions as regards the men, horses, stores, ammunition, harness, and equipment, and are bound to bring under his notice any important incidents connected therewith. They have, however, little concern with questions affecting pay. They inspect kits weekly, and use their discretion in backing the leave lists of the men of their divisions.

The subalterns go on orderly duty week by week. In addition to the ordinary work of a cavalry subaltern they have a large amount of harness and gun equipment to look after, and are responsible for their division in the same way as a captain is for his troop. Owing to their only being three in number, the orderly duty is both more frequent and onerous than in the cavalry.

Sergeants.—'The connecting link between the lieutenants and the men are the sergeants, or numbers 1. A sergeant is in charge of each subdivision, and is responsible to the lieutenant in the same way as the latter is responsible to the major.'[1] The battery sergeant-major has the general supervision over the drill, discipline, and general administration. The quartermaster-sergeant keeps most of the accounts, and looks after the pay, clothing, and stores. Below the sergeants are corporals and bombardiers.

Artificers.—In order to keep the horses fit for work and the matériel in good condition, there are a certain number of artificers, *i.e.* farriers, shoeing-smiths, wheelers, and collar-makers.

There is also usually a rough rider to instruct recruits in riding and to break in remount horses.

Gunners and drivers.—The duties of the gunners and drivers of a battery are quite distinct. The former have to work and serve the gun, and keep it in good condition, together with the ammunition, and all stores belonging to it. They have to perform all guard and escort duties, and the majority of the ordinary fatigues. They are taught gun, carbine, and marching drill, but not riding. In addition to their other work the gunners are liable to be called on to assist in grooming the horses, in taking them out to exercise, and generally in all stable duties.

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[1] Knollys.

They are armed with a sword bayonet. A limited number of carbines is allowed to the battery for purposes of guard and escort, and are strapped tightly on to the carriages, and not intended to be used for defending the guns. If the men were allowed in presence of danger to have recourse to small arms they would neglect their proper duty of serving the gun. The task of limbering up and unlimbering is, especially in the case of the heavier guns, hard work, and the men should be tall and of good physique.

The duty of the drivers is to ride and drive the horses of the gun-team, groom them, and keep the harness, both leather and iron work, clean, and furnish stable guards at night. They should know sufficient gun drill to be able to work the gun on an emergency. One driver is told off to each pair of horses in the teams both for field and stable work. Drivers should be short, squarely built men, as the horses should not be overweighted, and at the same time a good deal of strength is requisite to drive a pair, more especially those in the wheel. To be a good driver either in the 'lead' or 'wheel' is not an easy thing, and requires considerable judgment.

Gun detachments.—A gun detachment consists of the No. 1 and eight gunners, who either march with the guns or are mounted on the carriages. The extent to which the gunners are mounted is dependent on the discretion of the major of the battery. The men should be as fresh and fit for work as possible when the guns come into action, but, on the other hand, the horses must not be overworked by having to drag any unnecessary weight after them. While

Two of the men sit on the gun limber, two on the waggon limber, and four on the waggon body. It will be thus evident that the majority of the detachment are with the waggons.

In coming into action under the ordinary circumstances of war, it will rarely be advantageous for the waggons to follow closely after the guns. If, on the other hand, the men are dismounted, they will be unable to keep pace with the gun. A notable instance of the evils of the existing arrangement occurred at the Alma, when the guns of Turner's battery had to be served by members of the head-quarter staff while breathless gunners were seen plodding in the distance.

The defect is now partially remedied on account of the ability to seat men on the axle-tree boxes. When a battery is going forward into action, or is from any cause liable to be separated by a long interval from the waggons, three men mount on the gun limber and two on the axle-tree boxes, thus forming with the No. 1 a detachment six in number, which is amply sufficient for the working of the gun. The waggons follow the battery at a distance of from two to 500 yards in rear, according to circumstances.

Horses.—Horses for the service are bought by an officer specially appointed for the purpose usually as four-year-olds in time of peace. For war purposes special arrangements are made for getting five, six, and seven-year-olds, the price for the latter running up under the circumstances to an average of 55*l.* apiece. The horses in the Indian batteries are imported from Australia, or bred in the Government studs.

An artillery horse should be powerful in draught, and at the same time have sufficient breeding to be able to move with rapidity. The shaft equipment necessitates the employment of large powerful wheelers, and as a consequence the other horses should be high at the withers in order to facilitate the draught. The actual type of horses bought varies considerably according to the opinion of the buyers, and out of those chosen the best are picked for officer's chargers and for horse artillery batteries.

The minor details of the harness equipment, and the method of harnessing in marching, drill, or review order, can best be learnt by practical experience, and are only necessary to be known by those whose duty it is to see the horses properly turned out. It seems advisable, however, that the general system of harnessing should be explained, and the use of the various parts of the draught and riding equipment understood.

There are two methods by which the horse exercises its power on the weight to be drawn; by means of (1) a collar, (2) a breast strap.

The French authorities, after a series of exhaustive trials, adopted the breast strap instead of the collar. The system of harnessing with breast straps has the advantage of simplicity, lightness, economy, and suitability to horses of all sizes. In the Mexican expedition it was found practically impossible to fit the service collars to the remounts, which were very unequal in size and form. In starting the draught with a breast attachment it is easy to ensure that the traces are all stretched by the team before they take the weight, while with the collar there is more or less of a jerk. The main disadvantages are that the harness must be carefully fitted, that there is a tendency to cause slight galls, and that constant repairs are necessary.[1]

On the other hand, the collar is easier to fit, is stronger, and requires less repairs. For continuous work in drawing heavy weights the collar is undoubtedly the best, but for the ordinary field artillery team the merits of both systems seem equally balanced. The adoption in England generally of collar draught seems to be based on the supposition that the shoulders are confined by the breast strap.[2] There appears no foundation for this idea, and it would appear reasonable that on the ground of lightness of equipment some further trials should be made as to the applicability of breast harness to artillery purposes. All mounted non-commissioned officers

The lasso harness, with which a proportion of men in the cavalry and Engineer Train are furnished, is only used in cases of emergency.

If the lasso is properly attached to the saddle a horse can exercise a good deal of power for a short spasmodic effort, the strain being borne by the girths and breastplate.

Draught.—The actual draught is taken by means of traces, those of the wheel horses being attached to the splinter bar of the carriage. The line of the joined traces from the shoulder of the leader of the team to the splinter bar should be that in which all the team exert their strength. The wheel horses must, however, be of a powerful stamp, and the difference of height in all artillery horses is not much. Hence, as each horse of the wheel, centre, and lead exert their force by their shoulders they must of necessity pull slightly against each other when all in draught. The flank and hip straps and bellyband (*vide* Pl. IX.) should, therefore, be fitted so as to admit of a horse exerting his full power through the trace when *there is no horse in front of it.* The distance between horses in draught should be *at least* a yard.

The breeching of the wheel horses should be adjusted so that when they are in the collar about 18 inches should be left behind the horses' quarters and the splinter bar.

On the off horses is carried the valise of the driver, attached in the case of the wheel to a pad, and in the case of the lead and centre to a saddle, on which a man can in time of emergency be mounted.

The girth, crupper, and the various straps keep the parts of the harness taking the draught in their proper places, while the backband of the wheel horse takes the weight of the shafts.

The off horses, in addition to a leading rein, have a bearing rein to keep their heads up, and a side rein to prevent the horses bending round their neck on to the drivers who are riding the near horses. These reins are, however, only used for purposes of manœuvre, and are either slackened or taken off on the march.

An inspection of Pl. IX. will make clear the principle upon which the harness is fitted.[1]

Parade formations.—A battery is formed for the purpose of manœuvring either in line or column.

A battery in line is either at full interval (19 yards) (Pl. VIII.), half interval, or close interval. Guns nearly always come into action at full interval, and when there is plenty of space available, batteries move at full interval. When working with other troops or with other batteries, close interval is generally used.

The usual column formations are (*vide* Pl. VIII.)—

Column of half-batteries, or one half-battery complete drawn up behind the other.

Column of divisions, or each division complete followed by the others. Two guns abreast with their waggons behind them.

Column of subdivisions, or carriages two abreast, but each gun having its waggon to the side of it.

Column of route (the *ou* pronounced as in *lout*). The carriages form a string one behind another, each gun being followed by its waggon. This is the usual marching formation of a battery.

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[1] Lead:

	st.	lb.
Riding set complete, harness only	5	2
Driver, in heavy marching order, cloak and grooming articles included	11	7
Total weight carried by *riding horse*	16	9
Off-set and driver's kit (total weight carried by *off leader*)	6	5

Wheel:

	st.	lb.
Riding set complete, harness only	5	6
Driver, in heavy marching order, complete, cloak and grooming articles included	11	7
Total weight carried by *riding horse*	16	13
Off-set and driver's kit	6	12
Weight of shafts, 12-pr. limber, gunners mounted . . .	4	0
Total weight carried by *shaft horse*	10	12

Drill terms.—Most of the words of command used by the artillery are identical in meaning with those used by infantry. There are a few exceptions.

Right or left take ground corresponds to *right or left turn*, each carriage wheeling independently to its right or left.

Right or left reverse corresponds to *right or left about turn*, each carriage wheeling about independently.

Right or left wheel.—When a battery or a portion of it wheels, the front that is leading wheels on the right or left pivot, in the same way as the front rank of a company. The carriages in rear follow in their proper place like the rear and supernumerary rank. To *come into action* means that the guns are unhooked from their limbers, or *unlimbered*, and placed on the ground ready to fire. The *front* of a battery, while it is in movement or limbered up, is the direction in which the horses' heads are pointing. When the guns are *in action*, the direction in which the muzzles are pointing denotes the front. A battery has thus no fixed right or left, but is ordered to dress from either flank according to circumstances.

Action front, rear, right, or left.—When a battery is advancing, and the word *action front* is given, the whole at once halts. The gun is detached from the limber, and the trail swung round in a semicircle, so as to make the muzzle point to the front. The limbers and waggons reverse and go to the rear, and again reverse so as to form up behind the guns. In *action rear* the trails of the guns are detached and dropped on the ground, while the other carriages reverse so as to form up behind. In *action right or left* the muzzles of the guns are made to face in the required direction, while the carriages, by taking ground to the left or right, and reversing, form up as before. This latter order can only be given when the guns are following one another, as in *column of subdivisions*. For drill purposes the limbers are formed up ten yards in rear of the trails of the guns.

Front, rear, right, or left limber up.—The limbering up of a battery is the exact reverse of the movement necessary to bring it into action. The limbers drive up to the front, rear, right, or left of the gun trails, and as soon as the trails are hooked on, the battery resumes its marching formation.

Position of officers.—The major rides in front of the centre of the battery, shifting his post if necessary to where he can best superintend the movements. When a battery takes ground to a flank, the major does not shift his position, but remains on the flank, *i.e.*, to the flank of the two centre guns.

The captain's position corresponds to that of the major on the opposite side of the battery, *i.e.*, either in rear or on the reverse flank.

The subalterns always remain with their divisions, and will be according to the formation, either between the gun leaders of their division, or in front of them when there is no room, or on the flank of their leading gun-horse.

The Nos. 1, or sergeants, ride on the left of the lead drivers of their own gun.

The corporal, or second in command of the subdivisions, rides in a similar position with the lead of the waggon.

Drill of a battery.—The drill movements of a battery correspond closely to those of infantry in principle. It is unnecessary to go into the details of their execution, which is a purely technical matter, the knowledge of which is requisite for artillery officers alone. The apparent confusion which takes place in a battery when drilling, arises from a very simple cause. A gun with six horses cannot turn about on its own ground, or change the direction of its front without reversing, taking ground to right or left, &c., and covering a considerable space to enable the carriage to turn; whereas in the infantry a man can turn at once on his heels. Hence, in all cases of stationary pivots, changing of front, throwing back flanks, &c., the guns have to wheel about in order to accomplish the requisite change of front. The waggons, again, have to cover considerable ground in order to get in rear of the guns when they change position.

The following are a few typical cases of battery movements, the battery being formed up in the first instance in

Take ground to a flank.—Each carriage turns to the right or left, and the battery moves forward two abreast. (Pl. VIII.)

Advance in column of divisions from a flank.—The flank division advances straight to the front, the other divisions take ground till they get in the rear of the flank, and then follow in order. (Compare this with the infantry movement in Part III., s. 23, 'Field Exercise of 1877.')

Change front to the rear.—This movement is peculiarly an artillery one, and seems, though it is not really so, somewhat complicated. The subdivisions have each to change places, No. 1 with 6, No. 2 with 5, No. 3 with 4. Consequently each subdivision has to advance to the front and pass by a circuitous movement—bridle hand to bridle hand—the subdivision it has to change places with. (Pl. VIII.)

Change front to the rear when at close intervals.—The countermarch here cannot be made by subdivisions replacing one another, owing to want of space. One half-battery has to advance, and when sufficient room has been gained, both half-batteries wheel about, replacing each other.

Right or left wheel.—A wheel may be made either on a fixed or a movable pivot. In the former case the pivot gun will have to go to the rear and wheel about in order to come up square into its new position.

Change front right back, or *change front on No. gun.*—The movement is similar to that of battalion if the complication caused by the driving of the carriages be neglected.

Changing front when in action.—The named gun is at once faced in the new direction, and the two adjoining ones run into their position by hand. The guns further off are brought into position by limbering them up.

Movements from column.—From column of route to *form column of subdivisions.* The waggons form up on the right of the guns.

From column of route to *form column of divisions.* The even numbered guns move up abreast of the others followed by their waggons, the battery closing up.

From column of route to *form line.* The rear guns and waggons form on the leading gun by inclining or taking ground outwards to either flank.

From column of divisions or half-batteries to *form line to a flank.* This movement is effected either by at once wheeling up into line, or moving up successively to the reverse flank. ('Field Exercise of 1877,' Part III., ss. 26, 27.)

General rule.—All carriages move by the shortest way into their new positions in all movements by *inclining* (Pl. VIII.), or if it is thus impossible to bring them up square, *by taking ground.*

Pace of artillery.—The ordinary paces of artillery are the walk of four miles an hour, the trot and walk five miles an hour, the trot of eight miles an hour, and the gallop twelve miles an hour.

The trot is the pace of manœuvre, and should be regulated by the slowest moving horse. When no particular pace is ordered, the horses are supposed to trot.

Commanding officers of field batteries, when there is no necessity for hurry, frequently drill at the walk. They should never order the gallop—an essentially horse artillery pace—except for short distances in cases of great urgency.

The ordinary field battery drill is laid down for both guns and waggons, but on service the guns will move independently of the latter, which follow up the movements at a distance.

Commands and signals.—The noise made by a battery in motion, especially at the trot, is so great that it is often a matter of difficulty to make one's voice heard. The commanding officer should place himself to windward, and his word of command should be repeated by the subalterns prior to their giving the word to their divisions.

The bugle should not be used except to order the pace, or occasionally when the battery is drilling by itself, but never

Right reverse. Arm extended upwards and waved two or three times in a circle round the head.

Action. Arm raised as high as shoulder and then extended toward the ground, body well bent down.

General principles of field movements.—Artillery cannot be wheeled about on its own ground, and must, therefore, have room for the purpose both on its front and flanks. When acting with other troops a full interval (28½ yards) must be allowed for on the flanks. When ordered to form up with other troops the battery is halted well in rear of the alignment, and when the other arms are in position, it moves straight forward to its place in the ordered formation. The usual position of batteries when working with other troops is on the flank of the line.

When from any cause a battery has to pass through a cavalry or infantry formation, their commander should be informed in time, so that companies or squadrons may be wheeled back to give room.

The battery as a unit should not be broken up, and if of necessity divided, should separate by *divisions* in preference to *half-batteries.* All formations should be at full interval when practicable, and *reversing* should be always *to the right.*

Guns should be brought into action as rapidly as possible, and every cover afforded by the ground utilised. Both the subalterns and the Nos. 1 should dismount and personally superintend the firing.

In moving over rough ground the Nos. 1 should be well out to the front of their subdivisions, and if the character of the country is quite unknown, there should in addition be sent out a couple of non-commissioned officers to ride 150 yards in advance of the flanks.

The following methods of dealing with exceptional cases should be noted.

Distances on the march.—The distance of four yards should be kept between carriages, except in bad or hilly roads, when it should be increased. Closing up to recover lost space should be effected by divisions, not by single carriages.

Reversing in narrow roads.—'The carriages must be drawn up close to one side of the road, the guns and waggons unlimbered and reversed. The limbers are then brought to the front of the carriages, which are then limbered up. If there is not room to reverse the limbers, the horses must be taken out.

'Should the road be so narrow that the limbers cannot pass their carriages, the trails of the guns and perches of the waggons must be brought into a direction perpendicular to the road. If it has a bank on either side, the wheels must be run close to the bank, and the trail or perch made to rest upon it. On a dyke or road with a ditch on each side the gun-carriages and waggon bodies must be run as close to the edge as possible, and the trails and perches held up while the limbers pass. Great care must be taken not to run the carriages too far, and the wheels must be scotched or locked at the edge of the dyke or ditch.'[1]

Going up and down steep hills.—In going up a steep hill cast off the bearing reins, start the carriages up by subdivisions, increasing the intervals; rest if necessary by locking the limbers, move in a zigzag direction, and let the horses have time to recover their wind at top. In going downhill the drag-shoe must be used, or the detachment hold on with a drag-rope.

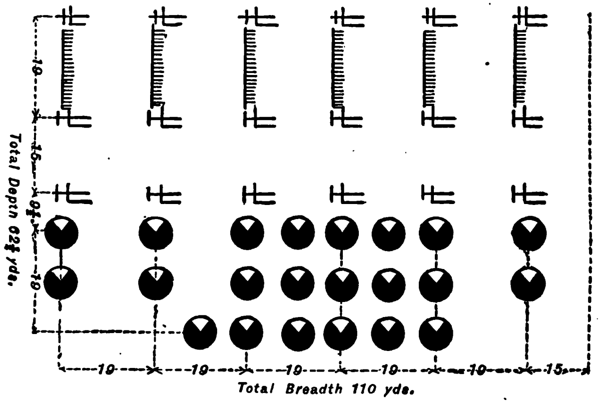
Accidents.—When a horse comes down and is unable to rise, the harness must be sufficiently undone to clear him, when he can be replaced by another if necessary. There is a detailed drill for dealing with accidents to any part of the gun-carriage and wheels. The wheels of carriages are all mutually interchangeable.

Encamping of a battery.—To encamp or bivouac expeditiously requires a close adherence to the drill laid down. In the regulations for encampment there are five different plans upon which a camp may be laid out, varying according to

For the ordinary bivouac or temporary encampment it is advisable to use the carriages instead of driving picket posts. Fastening the picket lines to the wheels of the different carriages is both the quickest and safest way of securing the horses. A glance at the figure below will show the arrangement recommended.

The carriages are always kept limbered up and the harness buckled together in rear of the pair of horses they belong to.

ARTILLERY ENCAMPMENT FROM COLUMN OF SUBDIVISIONS, *the picket ropes being made fast to the carriages.*



The position of a camp depends first upon military, secondly upon sanitary considerations. The character, movements, and proximity of an enemy must of course decide which reasons shall weigh most in the selection of a site.

Level open ground with a dry soil, and offering facilities for obtaining both water, forage, and fuel, should be looked for.

In estimating the space occupied by a battery the following data are useful:

A horse occupies a space of 3 × 1 yards in draught.

Between horses following each other 1 yard.

A gun-carriage or waggon with 4 horses occupies 11 yards.
,, ,, ,, 6 ,, 15 ,,
,, ,, ,, 8 ,, 19 ,,
Between carriages following each other allow 4 ,,
Guns are usually drawn by 6 horses, and with their interval . . . . . . 19 ,,

The front of a battery in line is measured from No. 1 to No. 1 when limbered up, and from muzzle to muzzle when in action.

Frontage.—The frontage of a subdivision in a field battery is three yards, including the riding horse of the No. 1. For a horse artillery battery the space occupied by the mounted gun detachment must be added, which makes it seven yards.

The frontage of a battery (field) in line at full interval is five subdivision intervals plus the front of a subdivision $= 19 \times 5 + 3 = 98$ yards.

The frontage of a horse artillery battery $= 19 \times 5 + 7 =$ 102 yards.

Where more than one field battery is deployed in line the front of a subdivision is only added to one of the batteries, and the artillery interval of 28½ yards allowed for.

Ex. Front of four batteries $= (4 \times 95) + 3 + (3 \times 28\frac{1}{2}) =$ 468½ yards.

In forming at half-interval, half the full spaces between subdivisions are allowed. In forming at close interval a space of four yards is allowed between the numbers 1.

Depth.—The depth of any formation is easily calculated from above data.

Ex. Depth of a battery in line is the same as the depth of one subdivision $= 15 + 4 + 15 = 34$ yards.

When in *column of route* one carriage follows another, and if there are twelve guns and waggons each with six horses, Half-column of batteries . $= \frac{123\frac{1}{2}}{2} = 61\frac{3}{4}$ yards.

Column of divisions or sub-divisions . . . $= (6 \times 15) + (5 \times 4) = 110$.

To find time of deployment.—Knowing the space occupied by an artillery force, and the rate at which it can move, enables an estimate to be made of the time within which a battery can come into action at any point.

Ex. 1. A brigade of four batteries is marching along a road, and is ordered to come into action on high ground one mile to the front. How long will it take to bring the guns into action?

The space occupied by four batteries in column of route from the leading to the rear gun

$$= (4 \times 224) - 19 + (3 \times 28\tfrac{1}{2}) = 962\tfrac{1}{2} \text{ yards.}$$

The space to be covered by the *rear gun* will therefore be

$$1 \text{ mile and } 962\tfrac{1}{2} \text{ yards} = 2552 \text{ yards.}$$

At the rate of eight miles an hour, this would be covered in eleven minutes.

Ex. 2. A brigade of four batteries is formed up in quarter-column of batteries. How long will it take to move off the ground in column of route?

Before the last carriage moves off parade the leading gun has to cover a space equal to that of the whole force in column of route added to the depth of the formation.

Four batteries in column of route

$$= (4 \times 224) + (3 \times 28\tfrac{1}{2}) = 981\tfrac{1}{2} \text{ yards.}$$

Depth of quarter-column of batteries

$$= (4 \times 38) + (3 \times 9\tfrac{1}{2}) = \underline{180\tfrac{1}{2}} \text{ ,,}$$

$$1162 \text{ ,,}$$

To cover 1,162 yards at a rate of four miles an hour requires ten minutes.

To estimate number of guns by time.—Again, knowing the rate of march, and the space occupied by guns, enables us to estimate the numbers of batteries that are seen in a distant column, a calculation that will often be of use on service. There are several methods of estimating an enemy's force.

The simplest, but one not always practicable, is counting the guns.

A rough but very useful rule is to estimate all artillery carriages to occupy twenty yards on the march. This is making an allowance for the inevitable tailing that occurs in a long column and the intervals.

Ex. A force of artillery is seen to pass by a distant tree for twenty minutes. It is estimated to be marching at the rate of three miles an hour. Find the number of guns.

The length of the column will be evidently one mile, as a gun would cover that distance in twenty minutes.

Hence total number of carriages $= \frac{1760}{20} = 88.$

Allowing a slight margin for spare carriages the number of batteries is evidently seven.

In estimating the value of any force by time, its rate of marching must be accurately judged. It must be kept in mind that when guns are marching with infantry they must keep pace with them, and that in a large force the pace will often be very slow.

CHAPTER VI.

ARTILLERY IN THE FIELD.

Rifled and smooth-bored guns—Increasing power of guns—Modern artillery tactics—General duties of artillery—Proportion of artillery—Units—Battery—Division and corps artillery—Reserve artillery—Ordinary march formations—Advanced guards—Main body—Ammunition columns—Zones of fire action.

Rifled versus *S.B. guns.*—The introduction of rifled artillery and breech-loading firearms has undoubtedly caused considerable modifications in the action of artillery in the field. Rifled guns are far more powerful, both in accuracy and effect, than the old smooth-bore at long ranges; but at short ranges, when accurate aiming cannot be ensured, and where rapid firing is essential, the inevitable elements of hurry and confusion lessen their value very much. It is often stated that the fire from smooth-bore guns at short ranges is greater than that of rifled ones. Whether this be true or not, it is an undoubted fact that the infantry fire at the shorter ranges has now obtained a theoretical mastery over that of the artillery which it did not previously possess. The practical effect, however, is lessened by the nervousness of the individual men. At different epochs one arm or the other comes to the front. The part played by the artillery and cavalry in 1866 was comparatively unimportant, while in 1870 they assumed a *rôle* which cannot be called a secondary one. In 1877, again, artillery did not appear so formidable as the experience of 1870 would have led us to expect, because it was badly handled. A mobile artillery, it must be remembered, is comparatively a new arm, and its proper use is only beginning to be understood. Its effect depends on the power of the gun and its proper tactical employment, and it is to a loss of recognition of the latter that the want of success of the arm occurred in 1866 and 1877.

Authors who treat of the application of the art of war, frequently dismiss the tactics of artillery somewhat briefly, and look upon the guns as simply an auxiliary to the other arms, which must always conform to their movements. Is this the case? Is it not a fact that the guns at Beaumont and Sedan of themselves gained a victory? The denuding of the centre of a line of battle of all troops but the guns, as at Wœrth, is surely a recognition of their playing something more than a subsidiary part. The fire from massed batteries, not only at the commencement, but all during an action, is an essential feature of the modern fight.

Increasing power of guns.—It is not pretended that artillery is, under present conditions, an absolutely independent arm, as it lacks defensive power at short ranges, but its power *is increasing*. There appears a limit to the yearly increase in destructive power of the infantry breech-loader. It may be assumed that a flatter trajectory for the bullet or a quicker arrangement for firing is practicable, but this does not alter the eyesight or nerve of the individual soldier. In exceptional cases the long range fire of infantry may be made more effective, but for the battle-field it is doubtful if the present range of destructive fire will be much altered.

On the other hand, an increase in velocity of a gun projectile will not materially affect the ranges of artillery fire. The limit of human vision is soon arrived at, and even with telescopes we cannot see behind a hill. It is useless firing at ranges in which the result of shell cannot be estimated. The actual destructive effect of a shell may, how-from those of the present time, and that, therefore, certain limits of range can be fixed as a basis upon which to erect a scheme of artillery tactics.

The advocates of what may be called the long range school have theoretically a good deal in their favour, but to lay down a tactical system to meet a hitherto untried species of warfare would be of little advantage. 'Is it not a characteristic sign of the present time that it is in the *small armies* that advocates are found for settling the question of long range fire according to the results of the practice range, whilst in the great armies it is settled on very different principles? It is thus reserved for those who have had no opportunity of gaining war experience to bring out the makers of theories and to push speculation to its extreme limits.'[1]

It would appear, then, that the relative value of the artillery and infantry arms on the battle-field in point of matériel is not likely to alter much, and that future improvements will tend to an increase in the power of the guns. In order to obtain the full power of the modern guns they must *come into action sooner and remain in action longer than formerly*, while in order to avoid great loss, they *must move about less than before.*

Modern artillery tactics.—The necessity for a regular system of artillery tactics is perhaps not at first apparent. It must be remembered that, in the extended order formations of the present time, the manœuvring of the infantry on the battle-field is very difficult. The changes of formations and tactical manœuvres of Napoleon's time are not now practicable. When a primal impulse is given to troops there can be made extensions of the line to the flanks, or reserves may be pushed to the front, but the main fighting lines are out of a general's hand. The infantry, in fact, have lost much of their power in manœuvring, the cavalry can seldom use their shock action on the field, and it is the manœuvring power of artillery that compensates for these drawbacks.

The important part which artillery has to play on the

[1] *Bericht über die Taktik der Infanterie.*—Liebert.

battle-field can best be realised by sketching out in general terms what the guns are really obliged to do.

General duties of artillery.—Artillery has firstly to *commence* and carry on the action at long range, dealing destruction to hostile men and matériel at a period before the action of the other arms is possible. In the *attack* it covers the deployment of the advanced guards, and aids them in pushing in the advanced posts of the enemy. With a sufficient escort it may surprise the enemy and (as at Beaumont) throw disorder into an unguarded camp.

On the defensive, it checks the deployment of an enemy, forces him to form at a distance in battle order, and delays his advance.

It plays an important part in all powerful reconnaissances, enables the numbers of a hostile force to be rapidly estimated, and the veil of the troops covering it to be rent.

It has, secondly, to *maintain the fight*—to keep down the fire of the enemy's artillery and infantry. The position of the enemy must be searched by fire, the approaches, ravines, woods, and cover, whether real or artificial, have to be successively dealt with. As an attacking force advances, the hostile fire against it must be checked, and at the same time the advance must be seconded by turning guns on the point of attack. Rapid changes of movement have to take place as the front of the guns becomes covered, while incessant enterprise from an enemy's skirmishers has to be feared and prevented. As a battle progresses, the flanks of a line have to be strengthened, or the guns brought up to cover a dangerously weak point.

When a force awaits attack in position, its guns have to keep down the fire of the hostile artillery, delay as long as possible the forward movement of infantry, protect the flanks from being turned, and aid in counter-attacks.

limited changes of formations practicable on the battle-field.

Lastly, the guns have to co-operate with the other arms in dealing a final blow at the enemy, following up his retreat if victorious, and covering the retirement of their own side in case of defeat.

From the above *résumé* it is evident what an important part artillery has to play on the modern battle-field, and to carry out that part it is necessary to establish certain tactical rules. In endeavouring to do so, care must be taken not to go too far. But little has been learned from the recent Russo-Turkish campaign, and if one goes back to the war of 1870, the inferiority of equipment and the inequality of the forces engaged, only enable certain main deductions to be drawn.

Proportion of artillery.—In view of the increased tactical efficiency of modern artillery on the battle-field it would at first appear that there could not be too many guns. Essential, however, as artillery may be to a fighting force, it can effect but little without the aid of the other arms. By itself it is very dependent on the features of the ground, it cannot move rapidly over broken country, is in danger when near cover of any kind, and cannot display its full effect except under conditions of *terrain* which only exist in limited areas.

The actual space available for guns on the battle-field has first to be considered. It is a notable fact that in the Franco-German war the Germans had the greatest difficulty in finding positions for their guns from the tendency to push their whole artillery into front line at the outset. An examination of the position of the guns and the extent of ground covered by the other troops, shows that in the first battles of Spicheren and Wœrth the German artillery occupied a space equal to one-third of the whole front of attack. In the battles of Colombey and Rezonville a fraction very slightly larger was used, while at the close of Gravelotte the guns occupied two-fifths of the German line.

On August 1, 1870, the invading army possessed 3·7 guns per 1,000 men, and as a considerable portion of these would of necessity be unable to come into action, it follows that the Germans could not, if they wished it, have used such a large number of guns as this decimal represents. The Germans, however, acted entirely on the offensive.

In considering a defensive battle it may be assumed that the guns can be placed closer together than the regulation interval, and that more than one tier of fire may be possible. Under ordinary circumstances there is sufficient room in a defensive line to place a force of three guns per 1,000 men without undue extension. In addition to these there will generally be some guns in reserve.

In the last war between Russia and Turkey in 1877, the former nation, acting on the offensive, had a proportion of 3·9 guns per 1,000 men, while the Turks only possessed about 2·2 per thousand.

Artillery on the march are practically confined to the roads, and unless these are numerous and the country exceptionally open for the movement of other troops, it is impossible to bring more than a certain number of wheeled carriages on the battle-field. If too many guns are taken, one of two things must happen, either the infantry are hampered and delayed by the occupation of the roads by gun-carriages, or a portion of the guns will be unable to get to the front in time to take part in the action. In the campaign of 1859 the French, with a proportion of three guns per 1,000, found it impossible to get them up to the battle-field. This was in a very close country. Undoubtedly the number and quality of roads has increased in modern times, but, on the other hand, the soil is more cultivated and the areas of free movement more restricted than they used to be.

The power of the infantry has been enormously increased by the introduction of the breech-loader, while the action of the cavalry on the battle-field has been reduced to small over, renders it less cumbrous and liable to block up the roads than was formerly the case. It has always been admitted that inferiority from any cause in the other arms can be compensated for by an increase in the number of guns. The undoubted effect of the modern short service system is to raise the quantity of the soldiery at the expense of the quality, and affords another argument in favour of a powerful artillery force.

It is generally admitted that from three to four guns per 1,000 is advisable, and the modern tendency is to increase the numbers to the maximum.

In nearly all the Continental armies they allot seventeen batteries to an army corps, which is slightly under four guns per 1,000. If there be in addition an army reserve of batteries, the limit of four guns will be generally reached.

It is somewhat curious to note that, after constant variation in the last 100 years between two and five per thousand, the proportion of guns has settled down to that recommended by Gribeauval and Napoleon.[1]

It must be remembered that the guns are the most stable element in an army. The numbers of the cavalry and infantry are constantly decreasing from losses in battle or sickness, while the guns remain always the same, except in cases of capture. As a consequence, the proportion of the guns to the other arms increases as a war goes on.

In the case of small forces there is scarcely a limit to the number of guns which can be brought on the field, as there is no question about room. During 1870 as many as ten guns per 1,000 men were known to be in effective action at the same time.

Units of artillery.—The battery of artillery is an admirable tactical and administrative unit. It is, however, too weak to perform alone very efficient work on the battlefield. Officers commanding batteries are naturally tenacious as to the question of command, and prefer working independently with other troops, to being grouped together in a higher artillery command. There appears no doubt, however, that batteries should be massed together to ensure fire discipline and effective supervision. In view of the large number of guns brought on the modern battle-field, and the consequent necessity for acting in masses, there is a distinct tendency to make the division the working unit. In our service, three batteries under the command of a lieutenant-colonel form the artillery division which is attached to each infantry division.

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[1] 'Il faut calculer sur quatre pièces par 1,000 hommes d'infanterie et de cavalerie.'—Napoleon. *Vide* an interesting paper on the proportion of guns to men by Capt. Baring, R.A.I. Papers, 1872.

A certain latitude should, however, be given battery commanders, especially when moving in close country. Fleeting opportunities may occur when a battery can come into effective action, while there would neither be time nor opportunity for the cumbrous division to form up.

In addition to the *divisional* artillery, a number of batteries are allotted to an army corps as *corps artillery*, which are divided into lieutenant-colonels' commands. To the corps artillery belong a number of horse artillery batteries, and from it are detached the batteries which cavalry divisions or brigades may require, or those demanded to carry out some special object. The strength of corps artillery is from six to nine batteries usually, and the total number of guns allotted to an army corps varies from 90 to 104. There is at present a general tendency to fix on seventeen batteries, or 102 guns, as a desirable force.

The term *corps artillery* is comparatively new. Prior to 1868 the guns not allotted to infantry divisions were massed together in one or more *reserves*. Having got rid of the idea that rifled guns enabled abnormally long ranges to be used, and realised that the preparation of the attack is the proper function of artillery, it became evident that to keep a *reserve* of guns out of action was a mistake. The name and generally confined to supporting the troops they are attached to, while the corps artillery is directly under the command of the general of the army corps, and is employed in the manner and for the objects best calculated to produce success.

Reserve artillery.—The necessity for having a force independent of the corps and divisional artillery is a matter upon which opinion is divided. The advocates of what may be called the German school insist that a reserve, even in name, should not be allowed to exist, that in the attack every available gun should be at once brought into action, and that even in the defence the retention of guns out of action is of dubious advantage.

The above views have been recognised by all nations, so far as to make them divide what used to be the *reserve* artillery among the army corps as corps artillery, instead of keeping it in one compact mass. No one disputes the truth of the arguments in so far as they relate to comparatively small masses of troops, but it may be fairly questioned if the results of the one-sided campaign of 1870–71 justify the abolition of a reserve altogether when large armies are in the field.

The necessity for as many guns as possible to come into action at the commencement of a fight is not incompatible with keeping a powerful, swiftly-moving force well in hand. The preparatory combat by artillery, when acting on the offensive, is especially needful; but it has been shown that under ordinary conditions it is impossible to get all the guns up in time, and that even if that were possible, there would be great difficulty in finding room to bring them into action.

It is therefore argued, that we should recognise this fact and utilise it to the utmost, by giving to the general in command a force in hand which he can employ at vital points when emergencies arise. The effective action of a reserve of guns when judiciously used is no new thing. 'C'est l'artillerie de ma garde qui décide la plupart des batailles, parce que l'ayant toujours sous la main, je puis la porter partout où il est nécessaire.'[1] The mere fact of having a reserve in hand does not prevent it being pushed into the fight at the commencement of an action *if there is room for it.* As a battle progresses the reserve guns can return to the hand of the commander, to be again pushed forward towards a decisive point.

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[1] Napoléon.

We may assume, however, that there is sometimes at first an impossibility to find room, or that the formation of march does not admit of guns coming up in time. As a battle proceeds, the artillery positions, either first, second, or third, become clearly defined, the weak parts of the enemy's line are gradually felt, and the advantage of pushing a *fresh* force into the fight to carry a decisive point is obvious. In considering the possibility of obtaining a position for the reserve guns, it must be remembered that the guns in the first artillery position have to move forward, that some of the batteries are liable to be silenced, and that large gaps in the fighting line, caused by the advance of other troops, become available. In any case the long range of modern guns allows of firing over the head of the attacking troops if no other method of employment is possible.

If the force of the above reasoning as to the offensive battle be admitted, still stronger arguments can be adduced on behalf of the defence (p. 204), and it would seem advisable to have a small *army reserve* composed of horse artillery batteries as possessing the greatest mobility. On the march, and prior to coming into action, such a reserve would with advantage remain with the bulk of the cavalry, and in the event of a cavalry battle, exert a preponderating influence on behalf of the side which possesses it.

March formations.—The order of march of a body of troops depends on the nature of the country, the number of good roads available, the object of the march, and the proximity and character of the enemy.

The following general maxim should be observed, that everything is to be arranged in column of route in the order in which it is likely to be required. When at a distance more mounted troops than would be useful for reconnoitring purposes.

The position of the artillery on the line of march varies slightly according to the numbers of the troops and the formation they are marching in. The paper strength of an English army corps, division and the smaller units, is shown on p. 102.

For the purposes of war, however, a considerable deduction must be made on account of sick men and horses, bands, servants, artificers, and non-combatants. The fighting strength of a regiment of cavalry and a battalion of infantry may be put down as 440 and 850 men respectively.

The combatants of an English division may thus be reckoned at some 6,000 infantry, 440 cavalry, and 18 guns. An army corps similarly would consist (excluding non-combatants) of 18,000 infantry, 2,600 cavalry, and from 90 to 102 guns.[1]

Advanced guards.—It is necessary that the guns of the advanced guard should be sufficiently near the head of the column to take part at once in supporting the cavalry in front when it meets with resistance. On the other hand, they must not incur the risk of capture or being fired on by the enemy's guns while on the line of march.

The constitution and tactics of an advanced guard are hereafter discussed, and it remains briefly to state that the space covered by it when preceding a division or larger body of troops would vary from about two to three miles in depth. If one battery only is attached it would march either in rear of the vanguard or at the head of the main body of the advanced guard. If more than one battery is used, one would march in rear of the vanguard while the remaining guns head the main body, preceded only by a fraction of the infantry.

The subdivision of the guns of a battery is to be deprecated. The modern field battery is a unit so small and mobile that there can be no necessity for dividing it except when a defile has to be passed through. At the same time there is no necessity for the whole of the waggons to be always kept with the guns, and it seems advisable to make the second line of waggons follow in rear of the advanced guard.

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[1] *Operations of War.*—Hamley.

Main body.—The main body of the troops follow in rear of the advanced guard at a distance of from half a mile to two miles, and are disposed on one or more roads according to circumstances. In the case of forces not larger than a division, which have only one group of guns to consider, it is easy to remember that the guns should march at the head of the column covered by a small force of infantry (usually a battalion). In the event of more than one road being used, the division of guns may be subdivided or not at discretion, but it would appêar advisable under ordinary circumstances to keep the batteries of the division together, as it simplifies the command and deployment into action. The artillery commander will determine to what extent the batteries march complete. In the proximity of an enemy the second échelons (*vide* Chap. VIII.) should, while on the line of march, let any infantry that wants to get forward pass them, but must take care to keep up communication with the guns they belong to. Where batteries or guns are required in the advanced guard, they will naturally be supplied by the leading divisional group.

When a large force, such as an army corps, is on the march the corps artillery is placed behind the leading division. Where more than one road is used, it would be on the road on which the head-quarter staff is advancing.

When divisions are marching in rear of each other, it will be apparent that the guns of the divisions in rear will be the latest to come into action. Hence they should be placed at the head of their divisions ; and it will be advantageous, if three divisions are on one line of advance, that the batteries of the two divisions in rear should be massed together, and march close to the head of the second division. The three batteries ammunition (see p. 167). These march in rear of the fighting troops, with those medical and commissariat trains which are necessary on the first day of a fight. The interval between the rear of the combatants and the head of the train varies according to circumstances, but should not be more than a mile. The reserve ammunition is expected, as soon as all the troops are engaged, to be in position one to two miles in rear of the fighting line. When divisions are marching one behind another, each reserve column would follow in rear of its own division.

The army corps reserve column of ammunition would march with the remainder of the train, and usually at its head.

Zones of fire action.—The consideration of the tactics of batteries is simplified if we consider the battle-field divided into zones of fire.

(1) From 2,500 to 1,600 yards from an enemy's line. At a distance of 2,500 yards the effect of shell can be fairly judged and good practice made against the hostile guns. In this zone the fire of artillery has alone to be feared, and the main object fired at will be the opposing batteries. The artillery plays the principal part, and a considerable choice of ground is available. As good a position as possible, compatible with securing unity of direction in fire, should be chosen.

(2) From 1,600 to 700 yards. The fire of artillery becomes very destructive, and the unaimed fire of infantry has considerable effect. The artillery must fight in this zone in conjunction with the infantry, and all advantages of position must be subordinated to the one object of aiding the infantry in their forward movement.

(3) From 700 yards up to the position. The destructive effect of infantry fire renders a change of, or choice of position only possible under exceptional circumstances. If the fire of the infantry is good and the artillery is not protected by gun-pits or shields, there will be a great loss of gunners. It is an established fact, that if infantry finds itself opposed by artillery and infantry together, it will direct most of its fire against the guns.

A modern army consists of a certain number of army corps or divisions.

Division.—The term division is applied to the first important combined unit. It is composed of the three arms, is of sufficient strength (10,000 to 14,000 men) to act independently with efficiency, and in the actual fighting of the battlefield is about the largest number of troops that a general officer can properly superintend. Confusion is apt to arise from the application of the term to various small bodies of troops. The English division is smaller than the Continental, and is more adapted to our varied requirements.

A division (without tents).

Staff—16 officers, 39 men	55
Two brigades of infantry (6 battalions)	6,706
One battalion rifles	1,097
One regiment cavalry	653
Three batteries artillery, 1 9-pr. and 2 16-prs.	573
One field company R.E. . . .	202
Ammunition Reserve Column . .	214
Supply and transport (in addition to that possessed by brigades . .	189
Medical, veteri-	

Each division has in first line—one transport company, carrying, amongst other things, one day's provision for the men.

In second line—one-half a transport company, carrying, amongst other things, a second day's provision for the men, and one day's forage for horses.

Army corps.—An army corps is formed by the junction of two or more divisions. An English army corps consists of—

Three divisions	30,462 men.
One brigade of cavalry	2,343 men.
Corps artillery	Three batteries horse, and 2 field.
Engineers	Pontoon troop, half telegraph troop, field park.
Commissariat, ordnance store, medical department, &c.	Comprising eight transport companies.
Total	37,045 men—12,939 horses—90 guns—1,573 carriages.

CHAPTER VII.

REQUIREMENTS OF A GOOD POSITION.

Necessity for a clear open range—Limit of range—Presence of cover—Weakness of flanks—Ground on the flanks—Slope to the front—Advantage of steepness—Height of position—Ground in the distance—Cover from fire—Natural—Artificial—Vicinity of a conspicuous object—Position of limbers and waggons—Soil in front of guns—Space for free movement—Re-entering *versus* salient spurs—Offensive positions—Defensive positions—Details as to gun-pits and artificial cover.

Before considering the bringing of a battery into action it is necessary to understand clearly what is the most effective position from which it can fire. This depends firstly on the features of the ground, and secondly, on the nature of the action to be fought.

Clear range.—A good position should afford a *clear open range both to front and flanks.* The fire of the guns should cover not only the country generally, but also every road and line of approach by which an enemy can advance. Where the ground is at all intricate or covered with obstacles, all exits from villages, woods, bridges, hollow roads, or anything in the nature of a defile, where an enemy's front is naturally contracted, should be within range.

The experiments at Okehampton in 1875 proved that from it. The field gun of the present day is still more effective, and has enlarged the possible zone of fire.

Limit of range.—On the other hand, it must be remembered that the effect of shell even with a powerful telescope is difficult to be ascertained at longer ranges than 3,000 yards, and that to fire without knowing the effect generally entails a useless expenditure of ammunition. Of recent years a great increase in knowledge has taken place as to metals and gunpowder, and is gradually leading to the making of heavier and more effective ammunition for a comparatively light field gun. One of the main difficulties of the future with regard to gun equipment is, how to carry a sufficient number of shell with a battery, and it is therefore of more importance than ever that not a round should be wasted.

It may be admitted then, that, although for the purposes of view the subject of range is limited only by the power of the telescope, yet that the advantage so obtained will be rarely utilised for artillery purposes for ranges exceeding 3,000 yards. As a matter of fact the actual visible range in fairly open country is seldom more than some two miles.

Presence of cover.—The openness of the range materially affects the question of the safety of a battery. An attacking infantry obliged to advance without cover over ground swept by the fire of a battery for 3,000 yards would be annihilated before coming to close quarters. The presence, however, of woods, villages, or even irregularities of ground, obviously aids the attack, and the main object to be avoided is the presence of cover within effective infantry range. If possible there should be no cover within 1,000 yards of the guns, and where it exists, the entrance into it, and above all the exit from it, should be capable of being thoroughly swept by fire.

Weakness of flanks.—The necessity of having an *extensive view to the flanks* is obvious. The flanks of a force of any kind are naturally weak, and a combination of a front and flank attack can seldom be withstood.

A good view will give a battery plenty of warning as to what is going to take place, and if an attack cannot be withstood, it will be able to retire or call to its aid the troops of its own side.

Ground on flanks.—The lie of the ground on the immediate flanks should be specially noted. An obstacle such as water, marsh, or precipitous ground on an exposed flank, enables a battery to hold its own till the last moment. It is doubtful, however, except when acting purely defensively, as in a rearguard action, whether it is not better to have a perfectly open flank and trust for protection to other troops.

An extensive position is also much strengthened if the high ground taken up trends somewhat back on the flank so as to allow the guns to be disposed in a retired échelon.

Slope to front.—It is commonly stated that a gentle slope to the front of about 1 in 100 is a great advantage. This may have been the case in the days of smooth-bores and ricochet fire, but it is difficult to see why it should be so now. The fact of a slope being gentle in the vicinity of a battery does not materially affect the efficacy of its fire at close quarters, while it gives effect to the ricochet of the bullets of the shrapnel and infantry of the enemy. A gentle slope, moreover, will be very rarely continuous for any long distance, and will be found to afford those undulations and hillocks within effective infantry range, which give the enemy's skirmishers exactly the cover they most want.

Advantage of steepness.—Even with continuously sloping ground the command of view to the front is rarely sufficient. A *short*, *steep* slope immediately in front of the guns seems preferable, as it gives a better command of view, and enables fire to be kept up with greater safety over the heads of the infantry, whether in the attack or defence. The ricochet fire of the enemy's shell or bullets will be ineffective, and the position of the guns being distinct from that of troops in

Height of position.—The height of the position should not be excessive. As long as a perfect command of view is obtained over the field of fire, the lower the situation of the guns the better. A plunging fire is rarely effective, as shells with percussion fuses have their effect destroyed by too much penetration into the soil, while the area of action of time shrapnel is much limited. Guns on very high ground are necessarily exposed if they are placed in a forward position on the crest in order to depress their muzzles.

In ordinary undulating country, by the side of the highest hills, are found lower necks and spurs upon which for choice the battery should be placed. A considerable command over the plane of site is of advantage solely in the case where the infantry of one's own side has to be fired over throughout the principal part of the action. The firing of artillery over the heads of other troops is undoubtedly a feature in the modern combat, but the necessity for doing so will seldom arise except when large bodies are engaged. In great battles, such as that of Wœrth in 1870, a line of guns on high ground can cover the advance of an infantry attack and allow an assailant to denude of troops a portion of the battlefield in rear of his fighting line.

When there is considerable choice of position, the ground occupied by the enemy's batteries must be carefully scanned, and a situation much lower than that upon which he is placed be avoided, as it will then be difficult to obtain cover for the limbers and ammunition waggons.

On the other hand, a slight command over the hostile batteries is of obvious advantage. If obtainable, a command of about 100 feet over the plane of site will fulfil most of the requisite conditions.

Slope of ground in the distance.—It has been stated that the effect of artillery fire is greatest when the slope of the ground in the distance conforms to the trajectory or path of the shot. With regard to this it must be remembered that the ground thus sloping would almost inevitably be hidden from view, and that an artillery officer could rarely afford to expend ammunition on unseen objects. No advantage resulting from the slope of ground in the distance can compensate for the limitation of an effective field for view.

Cover from fire.—*The ground should admit of the battery being sheltered from fire as far as possible.* The efficiency of an enemy's artillery fire depends upon his being able to regulate it by observing the effects of his shell. The presence of natural cover, such as trees, hedges, standing corn, or even houses, some one to two hundred yards to the front, so that the guns can just see over them, is an advantage, as it conceals their position with a sort of mask, and prevents the enemy from seeing the actual position of the bursts of his shell and thus estimating his range. A portion of the artillery of the First army were very effectively protected in the battle of Gravelotte by the trees in the Mance valley, over the tops of which they fired. In the same battle on the other flank some German batteries suffered but little loss owing to fields of standing corn in their front.

Artificial cover.—Failing natural cover, a gun-pit or gun-epaulment can be thrown up in ordinary soil in about an hour's time. The English gun-pit is complicated in construction, and has the disadvantage of limiting the lateral range of the gun. The protection afforded to the detachment is, however, good. The majority of Continental nations prefer to have the gun to fire over a low parapet, which has the advantage of not restricting the direction of fire, but does not give the same amount of protection to the gunners. The great drawback of artificial cover is that the earth thrown up forms a conspicuous mark. The actual position of the English pits can be somewhat concealed by connecting them with trenchwork.

Vicinity of a marked feature.—The vicinity of any conspicuous object, such as a house or prominent tree, should be avoided, as the distance to it has probably been calculated.

fantry fire, but when artillery plays on them they should be drawn back some seventy or eighty yards.

Position of limbers and waggons.—To obtain protection for limbers and waggons is difficult, owing to the necessity of having a constant supply of ammunition close to the guns. Shelter from view is not shelter from fire; and the common error should be avoided of collecting the horses in rear of a battery when there is a slight reverse slope behind the guns. Instead of shelter, a regular shell trap is formed, as the slope of the ground corresponds more or less with the path of every shell that misses the guns. It will generally be best to form up the waggons in rear of the least exposed flank of the battery. The limbers, if kept close to the guns, must be concealed as well as the ground will permit, or when time allows of it sheltered by throwing up epaulments. It is a serious question whether the horses should not be taken out of the limbers and placed in safety. The risk of heavy loss of horses during the combat appears greater than that of not being able to limber up in time.[1]

Ground in front of guns.—The ground for some 100 yards in front of a battery should affect unfavourably the enemy's fire. A clay soil prevents to a great extent the explosion of shells and ricochet of bullets or fragments, while stony ground is bad.

The presence of marshy ground, a railway cutting, or a ravine in front of the guns has the advantage of catching hostile shells and rendering them harmless if falling at all short, but has the great drawback of interfering with a forward advance either wholly or partially.

Space for free movement.—*There should be plenty of room for the guns, and facilities for advance and retreat.* The best position for artillery is behind the crest of a hill or undulation, the guns being placed as far back as is consistent with aiming. The ground should be firm and even, and the slope to the rear in the immediate vicinity slight. The guns of the future firing heavy shell at a high velocity and mounted on light steel carriages recoil some fifty feet, and although this may be lessened by mechanical means, it will still exist to an inconvenient extent, and should, therefore, not be increased by the slope of the ground. After sufficient space has been allowed for the recoil, a short steep slope sufficiently high to cover the limbers is of distinct advantage.

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[1] *Vide* p. 125.

The general line of guns should as far as possible be perpendicular to the line of fire.

In order to suffer the least loss, either in coming into action or in advancing and retiring from a position, the battery should advance at speed in open order by a straightforward movement. The ground, therefore, directly in front or rear of the position should be open and free from obstacles and in no place too steep to move over. In the case of isolated batteries this is not of so much importance if the ground admits of advancing and retiring by a flank.

The extent of ground from flank to flank should be considered with reference not only to the guns first brought into action, but also to those which may be reasonably expected to follow them. In taking up the position for an advanced guard battery, the divisional guns which are subsequently following up must be allowed for.

Re-entering v. *salient spurs.*—In the very ordinary case when troops are disposed on commanding ground, with spurs running out to the front, it is generally recommended that the guns be placed in the re-entering angles and be protected by the infantry on the salient spurs. The existence of this view shows how strongly the theoretical views of the 'defensive' maintain their ground against the practical experience of war. If modern warfare teaches anything especially strongly, it is that the power of guns should be developed to the utmost and not restricted, and that their place is in front line or in advance of it. Hence, as a rule, of a thorough knowledge of the features of ground which constitute a good gun-position cannot be over-estimated, but of course, a perfect situation can rarely be met with. He has to use judgment in endeavouring to obtain as many favourable conditions as circumstances admit of. In the case of an attacking force especially, a decision has to be very rapidly made. A careful scrutiny of the class of country he is passing over in his advance should forewarn him of the probable advantages and defects to be dealt with, and aid him in forming quickly a sound decision.

Irrespective of the ground, the condition of the warfare entered upon, and the plan and course of the action, materially affect the case. When a battery accompanies an attack, the first position taken up would, for choice, be on one of the flanks of the attacking front of the infantry. To fire over the heads of one's own troops unnecessarily would be a mistake. The object of the attack and the nature and composition of the enemy's forces must influence the movement of the guns. If the enemy displays but little resisting power, boldness in advance should be shown and comparatively little value be attached to cover.

Again, the effect of wholly or partially enfilading hostile troops is very great, and if the risk is not too much, it will be sometimes advisable to carry the guns at speed to a flank under protection of an escort.

In fighting against uncivilised and badly armed nations, the greatest boldness in flank movements and advance to close quarters can be practised with safety by mobile batteries provided the ground is fairly open.

It will often happen that a position, otherwise advantageous, is completely commanded by an enemy's batteries, and no cover can be obtained. In this case, instead of keeping on the crest of the highest ground available, it will be better to push the guns down the slope towards the enemy, thus rendering his fire more plunging and less effective.

In the later phases of the attack the position to be taken up does not admit of much choice. The action of the infantry has to be backed up as much as possible, and this can only be done by close support and making successive changes of position which aid, without hampering, its movements.

Defensive positions.—When acting defensively more time is usually available for studying the features of the ground and obtaining either natural or artificial cover. The position of the guns should be concealed as much as possible, as it is not advisable to bring them all into action till the full strength of the attack is developed. The possible necessity of having either to advance or retire must be kept in view; and as the actual plan of the attacking force is not, in the first instance, known, the guns in their first position may be further apart and more dispersed than is otherwise admissible. A valuable maxim to remember in all cases is that *efficacy of fire is the first consideration, cover the second.*

Several objections have at times been raised against the employment of artificial cover.

Artificial cover.—It is stated that epaulments offer a prominent mark, and that the guns being tied to one spot the loss becomes severe when the enemy obtains the exact range. If more than one gun is covered, a shell striking the crest of earth in front of any two guns will make an effective burst of what would be otherwise a harmless shot. The actual damage done to guns is generally slight, as was proved by the fact that in the three great battles round Metz only four guns were disabled. On the other hand, it is evident that a battery wholly exposed must suffer more than one partially protected. Experiments which took place recently at Vienna proved that a covering mass of earth stopped 49 per cent. of the shells fired against a gun. A still larger proportion of rifle bullets would be rendered ineffective.

When guns in the open are exposed to an accurate fire it may be necessary to retire them, but this may be done as well when covered by an entrenchment as without one.

battle of Gravelotte alone 25 per cent. of the men and 75 per cent. of the horses were either killed or wounded; and the use of shrapnel will in future increase the disproportion between losses in *personnel* and *matériel*. A consideration of the above facts leads to the conclusion that when natural cover is unattainable, artificial is a distinct advantage. The gun itself does not need much protection, but the gunners and horses require cover of some kind.

In considering the actual cover for the gun when it is being worked, the necessity of a wide lateral range must be recognised. In the Russian emplacements before Plevna the guns were able to train through an arc of 120°. In the French regulation gun-pit an angle of 90° is allowed for. Whether the guns should be placed on the surface of the ground or be sunk below it is a matter of opinion, and must depend mainly on the condition of the soil. In the late war in Turkey the Russians almost invariably followed the former, the Turks the latter course. By sinking the gun a smaller target is offered to the enemy's fire, but at the same time a certain amount of command is given up. Partially sunk gun-emplacements are generally advantageous when firing from high ground, as command is not lost and concealment more effectually gained. All sunken pits have the defect of filling with rain water in wet weather. When the surface soil is firm and level it seems a mistake to touch it; if, on the other hand, it is uneven or bad, a slight excavation cannot make matters worse, and may be an improvement.

The above-mentioned reasoning enables us to determine the principles upon which a gun emplacement should be formed. Cover for the detachment is first wanted, next cover for the gun itself, provided it does not interfere with having a wide lateral range, and thirdly, protection for a small quantity of shot and shell. The dimensions of the English gun-pit, which can be dug in about an hour's time, are shown in Pl. X.

An inspection of the plan and profile will make it evident that cover is at the *same time* obtained both for gun and detachment, thus attaching equal importance to the safety of both. By using an embrasure, the lateral range of the gun is very much limited and a conspicuous mark afforded to the enemy. In cases where of necessity lateral range is not wanted, and where infantry fire is more to be apprehended than that of artillery, the formation of the pit seems suitable.

For the ordinary work of the battle-field it seems preferable to follow the practice of Continental nations, who adhere more or less to one type of emplacement.

A good specimen is shown in Pl. X. extracted from a manual of instructions recently issued to the Russian artillery. Here cover is raised, firstly, to protect the detachment; secondly, to shield the gun if there is time. If material, time, and labour are available, the emplacement can be perfected subsequently to any extent.

In the case of guns acting on the defensive, there is generally ample time to construct gun-pits of any type which may suit the ground, and the method of digging them is of little importance.

In the case, however, of the attack, and always when the time available is either short or uncertain in duration, the excavating should take place systematically. Take, first, the type of pit, represented in Pl. X., when the gun stands on the natural soil.

1. Allow 15 ft. in breadth for the working of the gun. At each side of this space in line with the wheels dig a pit 7½ ft. long by 5 ft. broad and 3 ft. deep, throwing the earth to the front. A step may be formed in the trench if necessary, and this cover for the detachment should be made with the ordinary spades and shovels of the battery in from twenty to thirty minutes.

2. If more time is available, excavate in front of the gun a trench 15 ft. long by 2 ft. deep, thus forming a parapet 5 ft. thick and 3 ft. high, over which the gun can fire

height 3½ ft., but in front of the pits covering the detachment it may be a foot higher. Remember always to allow the gun to be trained through an arc of at least 90°. When there is any chance of being fired at obliquely, a return should be made of the parapet on the exposed flank. When the gun is sunk below the surface of the ground, so much additional earth is obtained that it is rarely necessary to dig a trench in front. The dimensions in plan of the English gun-pit may be adopted, but the cover for the gunners should be excavated at the very commencement and enlarged. This shelter cover in our type of pit is insufficient, the trench being small and termed an ammunition recess. The formation of a narrow embrasure is to be avoided in ordinary cases. A good type of the class of pit recommended is that adopted by the French (Pl. X.). When a number of guns defending a position have to be protected, and there is ample time, the erection of some traverses is of advantage. For rough, hastily thrown up cover, in which considerable protection is coupled with the ability to use wide lateral range, refer to the examples of Russian and Turkish gun-pits used in the last war, the construction of which is apparent from the plan (Pl. X.).

In order to minimise the defect of the newly turned up earth affording a conspicuous mark, it is advisable to cover it with branches of trees, sods, or soil of the same colour as that near it. A very effective plan again is to dig a small trench or parapet some fifty or sixty yards in front of the real pits, thus deceiving an enemy as to the exact spot from which the fire is delivered.

The system of protecting guns by either natural or artificial cover cannot be dismissed without referring to the advantage of indirect fire either on the defensive or in the attack of entrenchments. By withdrawing the guns a little distance down the reverse slope of a crest, and regulating the direction of their fire by means of pointing rods either in front or rear, the actual position of a battery is entirely concealed from the enemy while its fire at long ranges remains effective.

CHAPTER VIII.

ACTION OF A SINGLE BATTERY.

Subdivision of a battery for fighting—Ordinary order of march—When enemy is near—First échelon—Duties of commanding officer—Reconnaissance of position—Advance of the battery—Coming into action—Position in action—Horses unhooked—Supply of ammunition—Second échelon—Supply of ammunition—Fire discipline—Rapidity of fire—Control of fire—Ceasing fire.

Subdivision of a battery for fighting.—The organisation of an English battery at war strength has already been noted. In the armies of the first-class Continental military powers it has been found necessary to have ammunition waggons in addition to those allotted to each gun, and, owing to the increasing weight of field ammunition, we shall shortly have to follow their example. In the foreign drill regulations the batteries, before coming into action, are directed to subdivide into groups, either two or three in number. If the supply and baggage waggons, which are in some armies attached to artillery, be left out of consideration, it will be found that all batteries subdivide into a first échelon of the guns with from two to four waggons, and a second échelon of the remainder of the carriages, spare horses, &c.

The Austrians have four waggons attached to the eight guns in action, the French allot three to their six guns, the recently issued drill book[1] the necessity for subdividing a battery, though not exactly laid down, is virtually admitted. The following division is suggested as a basis to work with.

First échelon or fighting battery	6 guns and 2 waggons.
Second échelon or reserve . .	4 waggons, water-cart, forge, store waggon, spare teams, &c.

Ordinary order of march.—The carriages of a battery on the march keep together. In the ordinary order of march, called the 'column of route,' each gun is followed by its waggon. In rear of them comes the remainder of the carriages and the spare teams. Then follow any supply or general service waggons which may be attached.

The gunners, according to the discretion of the commanding officer, march on each side of their respective subdivisions, or are formed in detachments on that side of the gun which has a footpath or ground most suitable for the movement of dismounted men, or are massed together and march in front of the battery. When the ground admits of it, the carriages can march two abreast, thus diminishing the amount of space taken up, but no road must ever be filled from side to side with carriages.

When the trot is sounded, the gunners of the detachment mount on the limbers and waggons, which move forward. The remainder of the carriages keep ordinarily at the pace of the walk, and eventually rejoin the battery. If the battery has not its full complement of men, and all the *personnel* can get mounted on carriages—a case which will often happen when a battery is marching by itself—the whole of the carriages can take up the trot.

When the enemy is near.—When the presence of the enemy is signalled, or it is known that he is in the neighbourhood, the major prepares for the necessary subdivision of the battery. The word of command is given for the waggons to drop to the rear of the guns, and the six guns would lead.

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[1] *Manual for Field Artillery Exercises.* 1881.

The senior subaltern would then be put in charge of the reserve of the battery. He should be briefly told of the general line of advance of the fighting battery, and have orders given him to follow it at a walk, only trotting when it is necessary to keep the guns in view.

The reserve of the battery should, as a rule, keep off the roads as soon as it is left by itself, so as not to interfere with the movements of the troops, and also because it will be thus safer from long range fire. The subaltern in command should remember that his main duty is to bring up the carriages without loss to a position under cover, some 500 yards in rear of the alignment on which the battery comes into action.

In the case of more than one battery, such as a division or larger body, an officer would be told off by the artillery commander to take charge of the massed reserves.

The major, before galloping to the front to reconnoitre the position to be taken up, hands over charge of the *fighting battery* to the captain, and gives his instructions as to the probable line of advance, and whether he should at once trot or not.

The captain should, without delay, order the gun detachments to form the order of march, and see that everything is ready in the limber boxes, that the cartridges and fuses are handy, and that the proper gun numbers have the lanyards and friction tubes. The gunners are then mounted or not, according to circumstances.

Order of march of first échelon.—For long distances the roads are to be utilised whenever possible, according to their breadth in column of route or column of divisions. Broken ground necessitates a small front for passing obstacles, and, therefore, the column of route is advisable. When an advance has to be made across country, it is usually done at open intervals, the breadth of front being regulated by the nature of the ground and the space taken up by the neighbouring troops. An advance in line straight to the front at full interval is generally employed. The deployment into line should be effected before the guns get under fire of the enemy. If the ground renders it necessary, the intervals can be reduced to 'half' or 'close,' but the guns should open out to full interval as soon as practicable, owing to the disastrous effect of a well-aimed shell against any close formations.[1]

Any advance obliquely towards the enemy exposing a flank to his fire should be avoided. When it is absolutely necessary to take ground to a flank, column of divisions at close interval appears the best formation, though when any narrow passages have to be passed, the guns must advance singly.

Under an enemy's fire, the pace of field batteries should be a brisk trot, which may be increased to a gallop when near the position. Before the actual unlimbering, the pace should be checked to a trot again. The amount of space covered in the gallop will depend on the nature of the ground, the state of the horses, and the weight carried. Under an enemy's fire the ground must be got over in the shortest possible time, and none of the regulations of peace time, as to the proper pace of different kinds of batteries, should prevent a major from getting the utmost amount of speed he can out of his horses. The Austrian drill regulations lay down that over good ground field batteries can gallop for 500 paces in order to come into action. Batteries should not be required to trot more than a mile continuously.

Duties of commanding officer.—Whether there be one or more batteries, the *senior officer* who is in command rides forward to reconnoitre and fix upon the position to be taken up, leaving the guns in charge of the next senior. He then receives the battery or batteries in position, and regulates their fire and subsequent movements.

It is obvious that to choose the best position, the artillery officer must be acquainted with the results of a previous reconnaissance of the enemy, and also with the plan that the leader of the troops has formed. It is right then that he should keep with the staff of the leader till everything is clear to him, and then, having received distinct orders, he carries them out with regard to artillery detail. For the sake of simplicity, take the case of a single battery working with other troops.

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[1] Compare with Drill Regulations of Prussian Artillery.

The major, as soon as the enemy has been signalled, leaves the captain in charge of the battery, with instructions to get everything ready for an advance into action. He then attaches himself temporarily to the leader of the troops, and accompanies him till a decision has been formed as to what is to be done. During this time he should carefully scan the general lie of the country, see where the position is likely to be, and note the means of access to it from the battery. Following the major would be the range-taker and his assistant with their range-finding equipment and two trumpeters.

As soon as he has got the order to come into action to carry out some definite object, the major rides forward to the place where he estimates the battery should be placed. The general position to which the battery has to advance, or, at all events, the direction of it, is pointed out to one of the trumpeters, as well as any obstacles the battery is likely to meet with in its march and the best line of advance. A trumpeter is sent at once to the battery with orders for it to advance in the direction indicated.

As soon as the major has reached the spot where he thinks the battery ought to come into action, he scans the ground carefully and fixes on the actual position to be taken up. When the decision is made, and he knows the object at which fire has to be opened, the range-takers are told—if they have not already got instructions—to measure from the ground on the windward flank of the position the distance to some conspicuous point near the object aimed at. The range-takers should not leave their posts without orders, but continue finding the distances of points which it may afterwards be of advantage to know.

The other trumpeter, in the meantime, is placed so as to mark the position of No. 1 gun. When there is no matter of doubt as to the manner in which the battery can come into action, the major may, till it comes up, look after the range-takers, and by their help get a knowledge of the distances, actual and relative, of various parts of the *terrain* in front.

It will be generally feasible to get the distance of the next or second artillery position in case the battery advances, not for the purpose of knowing what that distance is, but to obtain approximately the range from it to the object aimed at.

When there is any difficulty about the manner in which the battery is to come into action, a matter which it would take time to explain to the captain, the major had better ride back and meet it, taking command himself, and giving the necessary orders.

Advance of the battery.—The officer in command of the battery, as soon as he knows from the trumpeter sent him the approximate position he has to take up, gives the orders for the gunners of the first échelon to mount, taking either two or three men on the limber, and two on the axle-tree seats of each gun. The two waggons carry their full complement of men. If three men are mounted on the gun limbers there will be with the battery 42 gunners, if two men only are on the limbers there will be 36. Three more men in addition can at a pinch be put on each waggon. As five dismounted men are sufficient for efficiently serving a gun, it is evident that any of the above arrangements will do.

The senior subaltern is given general instructions as to where he has to go with the second échelon of waggons. If this officer knows his duty it will only be necessary to point out to him his line of advance, which need not necessarily be that taken by the first échelon, but will generally be along the easiest available track.

The captain then gives the word of command as to the formation and pace for the forward movement.

In accompanying the battery in its advance it must be remembered that the ground it has to pass over is, in the generality of cases, but imperfectly known; and therefore, some mounted men should ride well in front in order to discover marshy places and natural obstacles. It will probably be best for the corporals in charge of the two ammunition waggons to ride forward some 100 yards in front of the flank guns, while the captain himself is some 200 yards in front of the centre. The Nos. 1 should also be well in front of their subdivisions.

If any obstacle has to be passed, a wave of the sword to the right or left points out to the subalterns the place of passage. It will be advisable for the officers with the battery to check the pace at once till the nature of the obstacle is known, and then work round or through it by half-batteries, or in column of route if no wider formation is possible.

Coming into action.—It depends on the state and nature of the ground, and the position of the enemy, whether the battery advances and comes into 'action front,' or whether it reverses before unlimbering and comes into 'action rear.' In undulating ground, where the guns are to be placed on the crest of a ridge, there will be less exposure to the *personnel* of a battery by reversing close behind the top of the ridge and then pushing the guns up by hand. It will sometimes happen that a flank movement prior to coming into action is advisable, the battery being in column of sections and the guns unlimbering to the right or left. This form of procedure will be generally used when the reverse slopes of ridges or undulations are steep and afford good cover to the battery while in movement.

The battery will be received in position by the commandant, who will explain to the officers the object to fire at, and give the necessary orders. The proper line of front of guns, the available cover, and the position for the limbers and waggons, will be rapidly pointed out, as of course the officers who advanced with the battery have not had sufficient time to study the ground in reference to these details. The guns should, in the case of a single battery, come into action simultaneously.

outlet is gained, to take ground to a flank and come into action right or left simultaneously.

In the most recent Russian regulations it is strongly recommended that a battery should come into its first position *loaded*, when under fire of an enemy. With a breech-loading gun there seems no objection to a previous loading with common shell, and time is undoubtedly gained. The loading would of course take place at the time the battery is beginning to separate its first and second échelons.

On nearing the ground to be taken up, the corporals in charge of the two waggons check their pace and halt some 150 yards behind the alignment till the gun leaders pass them, when they rejoin their waggons and await the order from the major as to their exact position. The waggons will be placed under cover as far as the ground will permit, and generally behind the least exposed flank of the battery at a distance not exceeding 100 yards from the nearest gun. They should never be on a road if possible, and have an easy access to the guns.

The best method of dealing with the gun limbers is always a question of difficulty. In order to be able to advance or retire without delay and to keep the ammunition close to the guns, they should be in rear of them at the regulation interval. When there is more than one battery, or when space, owing to the presence of other troops, is limited, there will be little choice in the matter. On the other hand, the horses of the limbers are generally, unless covered by a steep reverse slope, much exposed to loss, and it would seem preferable to place them behind one of the flanks, using any cover in the immediate vicinity.

The gist of the matter seems to rest on the manner in which ammunition has to be supplied to the guns. According to the English drill all the first rounds are drawn from the limbers, which are then re-filled from the waggons. In most foreign armies, on the contrary, they insist strongly on the necessity of not touching the limber boxes till the supply from the waggons is exhausted.

Assuming that the horses remain with the limbers, and that there are proper aids in bringing up ammunition from the boxes to the guns, it appears that the distance of the limbers in rear of the guns might be increased, when under heavy fire, up to sixty or seventy yards, according to the ground. With one or two batteries there seems no reason why the limbers should not be in rear of a flank, and thus not afford a double target to a single shot of the enemy, the waggons or their bodies taking position close in rear.

The regimental intervals of nineteen yards need not always be preserved, nor is the fact of one gun being a few paces in front of another of much importance. The natural cover afforded by the ground has to be utilised to the utmost, but at the same time the intervals should not be diminished to less than ten or increased to more than forty paces. In the former case the effect of an enemy's shell would be likely to affect two guns at once, while in the latter an effective superintendence of the fire of the battery by one man would be difficult.

Position when in action.—It is obvious that under a heavy fire every protection should be sought both for limbers and waggons, and that under ordinary circumstances the drill formation is one which exposes a battery the most. On the other hand, the ammunition must be close to the guns. Where cover is unattainable the following plans may be adopted.

1. Place the limbers according to the drill, but of course with horses facing to the rear. The waggons remain 100 yards in rear of the least exposed flank.
2. Place the limbers in rear of both flanks, with the waggons reversed in rear of, and close to, the centre of the battery.
3. Reverse the waggons in rear of Nos. 1 and 4 guns, and place the limbers behind the flank of No. 6 gun.
4. Drop the bodies of the waggons in rear of the battery,

Instead of the present cumbrous method of men doubling backwards and forwards from the ammunition boxes it would seem advisable to institute some system of hand-barrows or trays of ammunition which would admit of a large number of rounds being brought up at once without difficulty, and allow of greater latitude in obtaining cover for the horses.

Horses unhooked from limbers.—But there is another way of meeting the difficulty. The experience of late wars has shown that the greatest loss of artillery in action is always in horses and scarcely at all in carriages. Horses, if unhooked from the limbers, might be placed in safety and brought up when it is necessary for the guns to advance or retire. The cases when the movement of guns is an affair of seconds are very rare, and for general purposes it would seem advisable to unhook the horses and place them out of danger.[1] In special cases, such as those of horse artillery acting against cavalry, pursuits, retreats, and all occasions when great rapidity of manœuvre is necessary, the system of keeping the teams fixed to the limbers should still be retained, but it would be well to allow the officers commanding batteries some discretion in this matter. At present the rule is absolute, but it has come down to us from a time when the attack of infantry was always at close quarters, and the fire of small arms was only dangerous at distances of 200 yards and under. Now that rifle fire is effective far beyond the possibility of rushes on the part of an enemy, a change of the present system seems to be imperatively demanded.

The same may be said with regard to the men not absolutely required with the guns. It is difficult to see why any of the gun detachment should remain under fire unless their services are quite needful. Three or four men can work a light gun almost as well as eight, and the rest would be better occupied in resting in safety till their turn comes than in serving unnecessarily as targets for the enemy.

Supply of ammunition. — Before a battery advances, retires, or changes position, the non-commissioned officer in charge of the waggons should be informed of what is to be done, and the waggons simply follow up the movement.

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[1] The advantage of a pole over a shaft equipment is in such a case obvious.

After the battery has opened fire and the waggons are in position, advantage should be taken of every favourable moment to forward ammunition. It will seldom be possible to prevent the gun limbers from being drawn upon, and in such a case, as soon as they are half-empty, measures must be taken to fill them from the waggons, which will usually have to advance up to the limbers.

When the waggons are nearly empty, the residue of the ammunition is taken from them and deposited on the ground or in the gun limbers. The waggons then trot off to the second or reserve échelon, and are replaced by two or more full waggons according to circumstances. A call is similarly made on the reserve to make good losses in men, horses, or *matériel*.

Where several batteries are in action, the waggons will be necessarily exposed, as each set of waggons must keep in rear of its own battery, so that there may be no confusion in supplying ammunition. Each battery is invariably supplied from its own waggons.

Second échelon of battery.—The commander of the second échelon, as before related, follows up the battery at some distance in rear, keeping clear of the roads or lines of approach so as not to interfere with the advance of troops or batteries in rear. As soon as the fighting battery moves off the line of march, a trustworthy non-commissioned officer is sent with it, who will bring back any orders the major may have to give when the guns are in position.

When the guns unlimber for action, the officer in charge of the reserve chooses the best position he can find some 500 yards[1] in rear of the flank of the battery. The spot selected should be under cover as much as possible, and should be part of a battery. The German first échelon consists of four ammunition and one store waggon, and, being thus strong, the second échelon is placed in rear at a distance of some 900 yards. The French, on the other hand, form three échelons, and the waggons are brought under fire practically by threes.

Massed reserves.—When a division of batteries is working together the reserve échelons are usually massed under command of an officer. It will often be difficult to find a position under cover in such a case, and a good deal of discretion is allowed in fixing on a spot. When the waggons are posted, an orderly should be sent to the divisional commander, who should inform the major of each battery of the exact spot.

Supply of ammunition in second échelon.—The second échelon has to make good all losses of the battery in men and horses, and to ensure a regular supply of ammunition. As empty waggons come back from the battery, full ones are sent forward to replace them. When a single battery is engaged, the empty waggons should be sent back in pairs from the second échelon to the nearest divisional column to be refilled. When reserve échelons are massed, the commander must use his discretion in sending forward waggons if the demand from one battery is greater than from the others. The number and frequency with which waggons are sent back to the divisional reserves will also be left to his discretion, and will depend upon the distance to be travelled and the particular exigencies of the case.

In no case must the supply for the guns be allowed to run short, and if time presses, filled waggons should be demanded from the divisional reserves, while the empty waggons remain to be packed.

After an engagement is over all serviceable portions of the second échelon rejoin their batteries, while demands are made on the nearest divisional columns to make good deficiencies.[1]

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[1] *Vide* pp. 166–170, for the constitution of the divisional and corps ammunition columns.

Fire discipline.—The rules as to fire discipline are practically identical in all armies.[1] It must be attained by good instruction, and should exclude all errors and misconceptions as to choice of projectile, target, aim, range, and order of fire. The officer controlling the fire remains on horseback, posting himself as a rule on the flank of a battery, and, until the range is obtained, leaves it only under exceptional circumstances, when he must be careful to keep within such a distance that his orders can be distinctly heard.

In firing to obtain the range it is essential that the object aimed at should be clearly indicated, and that all the guns are correctly laid. As mistakes are liable to occur on this point, the major in command should, in doubtful cases, order an officer to verify the aim.

Whenever an order designates a particular flank of an enemy as the object to be aimed at, it must be understood as referring to the flank so called by the enemy, *i.e.*, the left flank of an enemy's skirmishers would be the flank to the right hand of an observer in a battery.

Rapidity of fire.—The usual order of firing is by guns in succession from a flank. Occasionally a salvo from the whole of the guns is advantageous when the range is accurately known and an easy target afforded. In firing case there is no time for one gun to wait for another, and the fire is independent. During the artillery duel, and at long ranges, the fire is slow, about one round every half-minute for a battery.[2] As an average, during the greater part of a fight the rapidity may be slightly increased, and each gun fire once in two minutes. At decisive moments, at close quarters, or when any momentary advantage may be gained, a rapid fire of each gun once every half-minute may be maintained for a short time.

Control of fire.—When a battery has to open fire under the tangent scale, and point out the target before coming into action.

The fire of a battery, when common shell is used, should be concentrated on one portion of the target, while shrapnel with time fuse can be used so as to burst over a considerable area in width and depth, a particular portion of the target being as far as possible pointed out to each gun.

Artillery firing against artillery can obtain the best effect by laying on a central gun if all are equally visible, otherwise on the one which is most conspicuous. If the wind is blowing across the range, the gun on the windward flank should be chosen.

When firing against masses of infantry the centre of their front line should be selected as the target. If infantry is in loose formation, shrapnel fire should be directed along the skirmishing line. An occasional round into the supports and reserves when they afford a good mark is also advisable. In cannonading field works and entrenchments the whole of the object must be searched with fire if possible, and every effort made to enfilade exposed faces.

A difficulty in firing with effect arises sometimes from smoke. After a number of rounds, the smoke on a still day hangs like a cloud in front of the guns, or the smoke from adjacent batteries may be continually drifting across and obscuring the target.

Ceasing fire.—Fire has occasionally to cease owing to inability to see on account of darkness, fog, or rain, or the front may be covered by friendly troops, over whom it would be unsafe to risk shooting.

When a battery is obliged to cease firing on account of having no more ammunition, it should wait in position till a supply comes up to it.

A battery when once under fire should not be relieved by another, but men and ammunition may be forwarded to it, while any fresh batteries come up in support in other positions.

A good plan to obviate the difficulty caused by smoke is to have an auxiliary target close in front of the guns. For instance, after a gun is laid on its target, notice where the line of sight touches any object, such as a bush or mound, some thirty to fifty yards in front of the gun. Where no natural object is available, a stake, or branch of a tree, can be put in the ground, which will give the line of direction for all subsequent rounds. Again, when smoke obscures the object aimed at, a gunner has a natural tendency to lay the gun on a point where there is the least smoke. This error should be carefully guarded against, and men encouraged to watch for the flash of the enemy's guns, and lay upon them where the smoke will be sure to be thickest. (*Vide* pp. 50 to 54.)

CHAPTER IX.

THE BATTERY OF THE ADVANCED GUARD.

Advanced guards—Their duties—Strength—Composition—Distance ahead—Proportion of artillery—Order of march—Position of the guns—Constitution of batteries—Examples—Advanced guard tactics—Advanced guard of a division—The attack—Position of battery—Progress of attack—Duties of battery leader—Choice of position.

THE duties of the artillery of the advanced guard are so entirely dependent on what may be called 'advanced guard tactics,' that it is necessary to comprehend thoroughly the functions and formations of this body generally.

Advanced guards, what they are.—An army always marches with as broad a front as is consistent with tactical requirements. This necessitates a division into several columns, each following a separate route. The object of the march, the nature of the country, and the number and direction of the roads, regulate the number of the columns.

Each column may have its own advanced guard, or one may serve for the whole army. It has thus been laid down as usual to detail for an advanced guard one or more units of the main body. An army composed of several army corps might thus detach one for its advanced guard, while a smaller force might send forward one or more divisions.

If this *general advanced guard* is kept within fighting support of the main body, it will be tactically necessary to subdivide it into several columns, each of which will be virtually an advance guard for the troops following behind on the same road. The action of an advanced guard covering a single column can thus be considered separately, if it be remembered that with a large force there will be a series of advance guard columns, mutually interlinked for marching purposes and acting in unison on the battle-field.

It is not advisable for more than a corps to march by one road, nor, if practicable, more than a division. An advanced guard can therefore be considered as a detached miniature army acting in front of a corps, division, or smaller body of troops.

Duties of an advanced guard.—The duty of an advanced guard is to facilitate the march and guard against surprise. The country passed through must be thoroughly explored and all obstacles to the march of the main body removed, the movements of the enemy must be closely watched and small hostile bodies driven back, while any advance in force has to be checked.

For the main body it has to afford security and obtain information. In presence of an enemy too strong to push aside, it has 'not to advance or retreat, but manoeuvre.'

It has thus two opposite functions to perform, one to be the eyes and feelers of the force, the other to arrest and contain the enemy. Modern warfare has to a great extent taken away the former duty and placed it in the hands of large bodies of cavalry sent a long distance ahead. The actual reconnoitring work of advanced guards would in any case be performed mainly by cavalry supported by horse artillery (*vide* Chap. XIII.), and we can confine our study to the consideration of the offensive, defensive, and manœuvring power of a fighting force.

Strength.—All detachments from a main body impair its unity of action when a crisis arises, and the duties to be performed are arduous, therefore no more men than necessary should be employed.

The modern tendency is to make advanced guards ex-on account of the numbers at his disposal, has a tendency to force the fighting and get engaged in an action which it is beyond his power to bring to a decision without the intervention of the main body, which is thus forced to fight, however unsuitable the conditions or disarranging to preconceived plans. The action of the advanced guards of the V. and XI. corps at Wœrth, and that of the 14th division at Spicheren, are notable instances of this. Hence strict orders should be given to the commanders of advanced guards whether they are to engage or not.

Assuming that advanced guards should, as a rule, 'manœuvre,' and not get involved too deeply in a preliminary fight, the modern strength seems excessive, especially if it be remembered that the effect of improvement in modern weapons is to increase relatively the *retaining power* of small bodies. In the case of small bodies of troops the function of resistance is performed by the main body, and only sufficient men are required in the front to prevent surprise.

The ordinary strength of an advanced guard may then be assumed to vary from a sixth to a tenth of the main body; but when the intention is to lay hold of an enemy and bring about a decisive action whether he wishes it or not, the strength of the advanced guard may be as high as a fourth or even a third. The battles of Gravelotte and Sedan are examples of such cases, which will frequently occur when the enemy is inferior.

The normal duties being to *observe* and *resist*, it is obvious that all three arms can be employed with advantage. The proportion of cavalry depends upon the opportunities afforded for reconnoitring, either by the openness of the country or the absence of a cavalry veil. The infantry and artillery form the resisting power, their relative numbers being mainly dependent on the nature of the country and the character of the enemy.

Distance from main body.—An advanced guard should be within effective support of the main body; and, at the same time, be sufficiently distant to give that body time to form up in battle order. The distance will vary in proportion as the nature of the country passed over lends itself to defence. For an English division and army corps an average distance would be one and two miles respectively. In the case of large forces the distance may be increased to a maximum of five miles, which should never be exceeded unless it be desired to seize rapidly some point or position, the possession of which would be worth the risk of incurring a defeat while beyond reach of support.

Proportion of artillery.—In the advanced guard actions in 1866 the want of sufficient guns acting boldly was much felt. One of the principal features of the artillery tactics in 1870 was the engaging in force in advanced guard actions, and the tendency of the latest writers is to exceed the proportion of guns employed in that campaign. The difference between modern and ancient practice on this point is most striking. Under the First Empire the advanced guard of a corps had often but two guns, and their main task appeared to be to open fire when the enemy was found in force in order to give notice to the army. The habit in the German army is for the troops in rear to march towards the sound of the guns. Guns formerly employed merely to give a danger signal are now recognised as a necessary adjunct to a lengthy preliminary combat. It may be assumed that a division attaches one battery to its advanced guard, a corps two and often three. In the case of bodies smaller than a division, if a battery is not allotted, two guns are sometimes used. The subdivision of a battery is, however, always to be deprecated.

Order of march.—The troops leading the advanced guard regulate the rate of advance of the main body. As, in addition to advancing, they have to reconnoitre and clear the way, they must be very mobile. Cavalry, then, when the ground admits of it, takes the head of the column, but when close to the enemy it generally drops behind the must be sufficiently far forward to meet the first shock of an enemy, and assist the infantry without exposing itself to capture.

A large advanced guard thus naturally divides itself into (1) A vanguard of cavalry, infantry, and pioneers—to reconnoitre, support, and remove obstacles. (2) A main body which follows the vanguard at some 500 to 600 yards, whose mission solely is to fight, for which purpose the infantry and artillery of which it is formed are disposed so as to come quickly into action.

Position of the guns.—The necessity of having guns at any moment to the front to meet the first shock of an enemy forbids that they should march in rear. The liability of roads and passages being blocked by on-pressing troops is apparent to all. The general opinion founded on the experience of the last two wars is, that the majority of the guns should be placed at the head of the main body of the advanced guard, but covered by a small force of infantry. The object of this small force is to prevent the battery being taken at a disadvantage if the vanguard is suddenly overwhelmed, and more especially to keep the guns with the main body. If artillery were placed at the head of the column, there would be a natural tendency for it to march at its usual pace and thus outstrip the troops to which it is attached.

In the case of a large advanced guard, such as that of a corps, one of the lightest field batteries may with advantage march in rear of the vanguard. Horse artillery is not suitable for this duty on account of the large target which it offers to the enemy. If a battery is attached to an advanced guard, it should keep together, any subdivision of it being a mistake.

Constitution of batteries.—The nature of the batteries of the advanced guard has been much discussed. Should they be composed of heavy or light batteries, or a mixture of the two? Advanced guard artillery may have to seize with rapidity a favourable and often exposed position. To move rapidly, mobility is requisite; to maintain successfully an unfavourable position, the most effective gun against troops is advantageous. Now, in firing against troops, the effect is proportional to a great extent to the number of projectiles fired. The lightest and most mobile gun can carry and, therefore, expend the greatest amount of shell, and it would seem a mistake to employ a heavier calibre than is *sufficiently effective*. In the attack of villages, earthworks, and obstacles of any kind the heavier gun has, of course, the advantage. In any case 'the artillery of the advanced guard has to come into action first and remain there the longest;' the light battery is, therefore, generally preferable as possessing the most ammunition.

The disadvantages entailed by the possession of two distinct calibres outweigh the advantages, and it will be difficult to foresee when each calibre is most effective. The possession of one calibre at any period when the other would be preferable has a decidedly bad moral effect on troops who ought to feel complete confidence in their own artillery.

It is advisable, then, to use light field batteries as a rule for advanced guards, only employing heavy ones under exceptional circumstances. Take, for instance, the case of the 4th Bavarian division the day the Crown Prince's army crossed the French frontier in August 1870. Its orders were to gain possession of the semi-fortified town of Weissemburg; a heavy battery was, in consequence, very properly sent with the advanced guard, but two days later, while following up with rapidity the retiring French army, a light battery was substituted.

In the war of 1870 there was constantly a difficulty in getting heavy batteries up to the front. If it be remembered that the German heavy battery was only half a cwt. heavier in draught than our present 9-pounder, it will be evident that arguments against having large calibres in advanced guard batteries apply with additional force when the weight of our 16-pounder is considered.

Experience of the war of 1870.—A few examples may be referred to with respect to the force and position of the artillery. For instance, in 1870 the 5th German army corps marched by a single road towards the River Lauter, which separates France from the Rhenish Palatinate. The duty entrusted to the advanced guard was to precede the corps to within about a mile of the frontier, then to divide into two columns, cross the Lauter, take up a position on the opposite bank, and establish connection with the neighbouring columns. Two light batteries were attached to the guard.

While marching on a single road one battery was detached to the vanguard and marched with its support, being preceded by two squadrons and six companies, and followed by a battalion. The other battery followed at the head of the main body of the advanced guard, but covered by a battalion. On reaching the neighbourhood of the river a division into two columns was made, one battery being detached to each.

Advanced guards were generally reinforced with guns before an engagement. Thus the two batteries of the 11th army corps, on the morning of Wœrth, were strengthened by two others sent forward from the divisional artillery.

The advanced guard of the 13th division (1st German army) crossed the frontier with one light battery near Saarbrucken, but on hearing the sound of heavy firing at Forbach, which it was approaching, another battery was added.

General tactics of an advanced guard.—An advanced guard must not let itself be stopped by demonstrations of small bodies of the enemy. One of Frederick the Great's maxims was, 'Never haggle with the enemy's light troops.' The leading line of cavalry or infantry should at once be strongly reinforced, and the enemy driven back without delaying the advance of the main body. Generally speaking a vigorous offensive is desirable when the enemy is first seen, and this is a good argument in favour of strong advanced guards. Even when an enemy is in force, it is best to attack energetically and drive him back as far as possible. The moral effect of the attack of the leading troops of an advancing force is very great. It imposes on an enemy and enables strong localities to be temporarily captured, which modern firearms ought to enable one to hold defensively, at all events, for a short time. If an enemy is formed in position the advanced guard commences a *reconnoitring* action with the object of gaining information and finding out how the enemy occupies the ground. The guns come into action at long range and fire slowly while the cavalry work towards the flanks and reconnoitre.

Great care must, however, be taken not to interfere with the plans of the leader of the main body by getting so deeply committed in an action with superior forces as to be unable to extricate the advanced guard without involving the whole main body in an unlooked-for battle. The battle of Spicheren may be instanced as an example of the evil effect of an advanced guard action rashly entered upon. The chief command during the battle changed no less than three times, battalions were hurried forward one after another, and it finally concluded with the barren result of a defeated enemy retiring without further loss than that incurred during the action—a loss less than that of the victors. In this case it was not the intention to attack the enemy on that day.

When the advanced guard is obliged to act *defensively* by reason of the attack of a very superior force, its duty is to hold its ground at all hazards. The main body of the advanced guard must take up as strong a position as possible, strengthen it artificially, and delay the enemy till the main forces come up. In assuming a position care must be taken to leave ample space for the main body to come up in, and its line of advance should be left clear.

Cavalry and guns would generally be on the flanks of the line, and the guns must be sacrificed rather than retire.

The task of defence is rendered the easier from it being should have previously noted the strong and weak points of the country when passing over it. If possible, the action should take place to one flank or the other of the main line of advance. It will be thus evident that an advanced guard action will be characterised by either a vigorous offensive, a manœuvring action, or a defensive engagement, according to the strength and dispositions of the enemy met with. It is apparent that to gain early information about the enemy is of vital importance, in order both to carry on the advanced guard action and enable the general of the main body to form the best plan. When this information cannot be obtained by the leading scouts or cavalry, it will be the task of the advanced guard to elicit it by alternately threatening and manœuvring with the troops in hand.

The advance guard of an infantry division.—The preliminary combat is in the generality of cases the function of an advanced guard. It is necessary to examine briefly the different ways in which an action commences under varying conditions, and to study especially the part played by the artillery. For the sake of simplicity the advanced guard of a division is first considered, as it would in most cases be composed of a single battery.

Take the case of a division marching to meet an enemy. The cavalry of the advanced guard will be well out to the front reconnoitring to find out where the enemy is. It will first meet with the hostile cavalry, and, according to the opposition encountered, obtain more or less intelligence.

Sufficient information can, however, be rarely gained ; the cavalry, even if successful, will inevitably be checked by the outlying infantry, and it will have to take ground to the flanks, leaving the advanced guard to complete the information by an offensive reconnaissance. Whether the enemy be advancing or retiring, or prepared to make a stand, a moment must arise when the bulk of his forces prepared for fighting is covered by some advanced troops in front, and it is the struggle with these advanced forces which forms the preliminary combat.

Before this moment arrives, an advanced guard may have some little fighting in driving in the infantry supports of an enemy's advanced guard, or pressing his retreat, but in such cases it becomes a struggle for localities where small forces are engaged—a species of warfare which will be dealt with subsequently.

It is after this petty warfare, after the clearing of the ground by the advanced guard troops, that its true function becomes apparent, which is to reconnoitre sufficiently the main force of the enemy.

Enlightened by the result of this reconnaissance, the general of the division is able to decide whether to carry out the attack or refuse the fight and act on the defensive if pressed. Viewing the advanced guard duties in this manner, it will be evident that an advanced guard action may partake of an *offensive* or *defensive* character, and may change from one to the other.

The attack.—Assuming that the cavalry on both sides have of necessity cleared away from the front, and that the space between the contending forces has been freed of all petty detachments, by a vigorous forward movement the advanced guard comes within striking distance of the enemy.

The commander of the advanced guard, partially informed of the state of affairs, rides well forward accompanied by the major of the battery. The position of the enemy's advanced posts are noted, and the artillery officer made acquainted with the proposed plan of attack.

The major will then proceed to bring his battery into action (Chap. VIII.). It must be recognised that the preliminary combat will take place between the advanced guard and the advanced posts or outlying troops of the enemy. It will not be possible to push the infantry forward under the fire of the main position, and the battery must keep out of the effective fire of its guns on account of the risk of being overobjectionable. The enemy's position is not sufficiently well determined to make it clear that an enfilade fire from a flank would be advantageous, and the risk from attack in an isolated position would be great.

The actual distance from the enemy's outlying posts at which the guns come into action depends mainly on the ground. Care must be taken to keep outside the infantry fire of the advanced posts and the artillery fire of the main position. These conditions will generally be fulfilled by a distance a little short of a mile from the point of attack.

Progress of attack.—As the infantry advance and get near the guns, they deploy for attack, and it is the first duty of the artillery to cover the deployment. If the advanced posts of the enemy are furnished with artillery, the guns of the battery should be directed upon them. If skirmishers are out in front, they should be shelled with shrapnel. The infantry of the attack gradually advances, and their progress must be helped if necessary by the vigorous fire of the battery against the point of attack. As the reserves of the infantry line pass the guns, the battery will probably have to advance, but it must in no case come under the *decisive* fire of the artillery of the main position, *i.e.*, nearer than 2,500 yards.

The progress of the advance will inevitably be checked either by the fire of the main position or the inability to drive in the advanced posts. Nothing more can be done till the main body arrives on the ground, supposing always that the enemy remains in force. It is the duty of the advanced guard to ascertain this, and not to be checked by mere demonstrations.

Duties of the major.—As a general principle the officer in chief command of any small body of artillery accompanies the commandant of the troops until he receives his orders to bring the guns into action in a certain locality for a definite object. After this he remains with his guns, and is personally responsible for their subsequent employment. If the chief commander changes his plans, he must inform the officer commanding the artillery.

Choice of position.—In an advanced guard action the position to be taken up will be generally near the furthest point to which the officer in chief command has personally reconnoitred. The major will therefore have ample time to examine and choose the ground.

In choosing a position (Chap. VII.) special care should be taken that it is a strong one for defence. The offensive power of the advanced guard battery is but little, while, if forced to take the defensive, it is of the utmost importance to be able to hold its ground, and afford a solid point of support for the infantry. The battery will be received in position by the major according to the principles laid down in Chap. VIII. If he has not had the opportunity of examining the ground over which the battery must advance, the trumpeter who takes the order back to the captain should be directed to traverse that ground in his gallop, so as to be able to give some idea of it to the officer in charge of the battery.

It should be remembered that, if the ground is open and does not afford cover for the advance of hostile skirmishers, a battery can *defend its own front.* When an attack on the flanks is threatened, a change of front to meet it can be made, or the battery may take ground to a flank and get near to its own supporting troops. Under no circumstances should the advance guard battery retire, unless an obvious mistake has been made as to the proper place in which it should have come into action.

In many cases, and especially when the position taken up by the artillery of the advanced guard is favourable for commencing the main attack, the divisional or corps artillery will be sent forward to support the advanced guard, as the batteries can move to the front more quickly than the infantry. In such cases the artillery becomes at once the principal arm, and the rest of the advanced guard will act chiefly in

CHAPTER X.

THE ATTACK OF A SMALL FORCE SUCH AS THE THREE OR FOUR BATTERIES OF DIVISIONAL ARTILLERY.

Preliminary—First deployment—Advance of the batteries—Position advanced to—Independence of advanced guard battery—The reconnoitring position—Advance to the first fighting position—Distance from enemy of this position—Details as to position—Description of the opening of an attack—Preparation for advance—Progress of the attack—Advance of the infantry—Example—Necessity for guns to advance with infantry—Distance to which guns can advance—The second artillery position—The advance from first to second position—The assault—Conduct in case of success or failure—The position taken up during the action—General duties of commander—Movement of the batteries—Into position—Changing position—March formations—Fire discipline—Nature of fire—Rapidity of fire—Object to be fired at—Supply of ammunition—Divisional reserves—Army corps reserves—Commissariat reserves.

Preliminary.—In considering the duties of artillery in the attack let us first take the case of a comparatively small number of troops, such as an infantry division of about 8,000 men, with its three or four batteries of divisional artillery.

The advanced guard, as has already been shown, takes part in the preliminary combat, and endeavours to push back the enemy's advanced posts and expose his actual position. Before a regular engagement a moment will arrive when the advanced guard is definitely checked, and can do no more than hold its ground and await the arrival of the main body.

During the preliminary combat the general of the division would, with his staff, advance to view the progress of the fighting, and collect all the information which the reconnaissance of the cavalry or the offensive action of the advanced guard had produced. He then decides whether an attack is likely to be attended with success, or whether the combat should be refused, or temporarily delayed till larger bodies arrive in support.

First deployment.—Assume that an enemy has made a definite stand, and that an attack with the whole of the division is decided upon. The actual plan of attack cannot yet be formed, but the deployment of the main body must be ordered to take place. A decision must be at once arrived at as to where this deployment is to be made, whether opposite the front or flanks of the position. The lie of the ground, the manner in which an enemy has apportioned his troops, and the direction of his line of retreat, will mainly affect this question. By this deployment of the main body is meant the collection of the division into a first, second, and third line of battalions at a spot out of range of the enemy's artillery fire. The force can then be moved, if necessary, to a flank before assuming with the front battalions the normal formation for attack. It would be a mistake to assume the regular attack formation too soon, as a change of direction or an alteration in the plan of attack is, in the modern extended order formations, very difficult to carry out.

The time necessary for a division to deploy from its line of march obviously depends on the numbers and the marching formation. As soon as the position of what may be called the *rendezvous* is fixed, the commander of the artillery is acquainted with the fact and the probable plan of attack as far as it can be foreseen. It may happen that the advanced guard has been forwarded an exceptionally long distance from the main body, or that a decision cannot at first be arrived *enemy's artillery* at least partially before any frontal attack of the infantry is delivered.

Advance of the batteries.—It is evident that the battle must commence with an artillery duel of more or less long duration. In order that a superiority should be gained over the guns of the defence, every available battery should be brought into action, and it appears a mistake, in the case of small forces, to attempt to keep any guns in reserve. The divisional batteries would be marching near the head of the main body of the division, and usually preceded by a small infantry force, such as a battalion. Before the combat the batteries would be formed in fighting order, each with its first échelon of two waggons, the second échelons being massed together in rear under the command of a specially detailed officer.

On the order for advance being received the guns at once deploy, if the ground admits of it, into line at full interval, and proceed at a rapid pace by a direct forward movement to the position indicated by the officer in chief command.

Locality of position.—Pursuing the course of the ordinary fight, it must be remembered that the advanced guard battery is in action, just within range, beyond the effective fire of the artillery of the defence, at a distance from it of some 2,500 yards. On one flank of the advanced guard battery will be the main body of the advanced guard infantry, the whole force being presumedly checked and holding its ground in the presence of a superior force of the enemy.

The divisional batteries have to come into action on *one flank or the other* of the advanced guard, and at about the same distance from the enemy as its battery. In determining the proper flank to come up on, the following considerations should be kept in mind.

The artillery commander should try to place his guns as nearly as possible in the *middle of the front of advance* of the division. By attaining this position the flanks of the guns are covered by the approaching infantry, and it will be rarely necessary to have any special escort. To get away to a flank is dangerous, and exposes the guns to an enemy's attack, while it is impossible to support them except by cavalry. Under *exceptional* circumstances an advantage may be obtained by enfilading a portion of the enemy's line, and this may, very likely, be done afterwards; but it must be remembered that the object of the artillery is to clear the way for the infantry, and that can be most effectually done at first by directly battering the enemy's position in front of it. Owing to the limited amount of ground covered by a division in its attack, the centre and both wings of the enemy opposite to the line of advance can be swept by fire from a central spot. To gain, moreover, the dubious advantages of an enfilading position at long range, the batteries themselves will have to make a flank movement and be exposed to a destructive fire while doing so.

In order to gain their position it will be obvious that the divisional batteries will come into action either

(1) On the unoccupied flank of the advanced guard battery, in which case all the guns of the division will be massed—a result most desirable—or,

(2) In line with the advanced guard battery, but with the infantry of the advanced guard separating it from them.

Independence of A.G. battery.—Although the divisional batteries thus come up to the advanced guard battery, the latter does not fall at once under the control of the commander of the larger force. Of course all details as to ranges and effect of shells is obtained from it, but the advanced guard battery has still to work with its own troops under the command of the leader of the advanced guard. No artillery officer can take it away from its already defined duties, and the battery should continue to work with the advanced guard troops till the end of the action, unless it obtains an order from the general commanding the division to a contrary effect.

The reconnoitring position.—The whole of the guns are now in action at a long range from the enemy's main position, and commence a slow fire with two principal objects: (1) to find out the exact position of the enemy's batteries, and (2) to keep down the fire that had hitherto checked the advanced guard in its forward movement. As a necessary result of the powerful aid afforded to it, the infantry of the advanced guard are enabled to push forward some 500 or 600 yards, and drive in the advanced posts of the enemy in front of them. In the event of there being artillery in the advanced posts, or if a point in front is strongly held, such as a farm, wood, or village, a concentrated fire of the guns combined with a forward movement of the advanced guard infantry should be able to clear it without difficulty. The action of the guns in the *reconnoitring* position may be assumed in all cases of small engagements to result in the *driving in of the enemy's advanced posts.* As soon as the enemy's skirmishers have been driven back and the advanced guard affords a sufficient support, the whole of the guns are pushed forward rapidly to their *first fighting position.*

Advance to the first fighting position.—It may often happen that the enemy's outlying troops are few and unsupported, and that there is no necessity to come into a *reconnoitring* position. The commander of the artillery must form a decision on this point, and if he thinks the troops of the advanced guard can give him sufficient support, he should, without delay, push at once into the first fighting position.

It may happen that the advanced guard battery has already been able to get into the first fighting position, in which case the divisional batteries come up on that flank of it from which they can most effectively aid the infantry attack. In the ordinary case, the advanced guard battery should limber up from its reconnoitring position and advance with the other guns, while the advanced guard infantry place themselves as far as possible as a support to the massed batteries.

It is obvious that before coming into action in the fighting position, whether it be done at once or with an intermediate stage of a reconnoitring position, the officer commanding should know the direction of the infantry attack, and place his guns accordingly. The difficulty as to knowing where the guns are to come up is really not great, as it is virtually fixed by the action already taken by the advanced guard. The guns have to come into action on *one flank or the other of the advanced guard.*

There may, of course, possibly arise a case where the advanced guard have made a mistake, and have entered into an action against a part of the enemy's line where it is obvious that the main part of the fight will not take place. In such a case, however, the mistake would be seen before the divisional batteries commence their advance, and the commander would at once lead the guns to a *reconnoitring position* in another part of the field, trusting for support to the nearest available troops, and leaving the advanced guard to extricate itself gradually from its false situation.

Distance of first fighting position.—There appears a good deal of difference of opinion as to the distance of the first position of the attacking guns from the enemy's line. The main object of the artillery in the first place is to silence the enemy's guns, which can be best effected by a heavy shrapnel fire against the *personnel* of his batteries. With guns of the modern type, shrapnel is effective up to 3,000 yards.

On the other hand, the guns from their first position should be able, without moving, to aid the infantry attack, and for this purpose should be as far forward as possible. During the whole time that the infantry are deploying and advancing (which, in the case of a division, may be assumed to be from 1½ hours to 2 hours) the guns should be firing.

Since 1870 the infantry weapon has been improved in range and accuracy, and long-range infantry fire up to 2,000 yards cannot be entirely neglected. Such fire cannot, however, prevent batteries coming into action, and it is only those infantry pushed out in front of the enemy's line whose advance up to effective range (about 800 yards) has to be feared. As long as the batteries have sufficient support—such as that afforded by the infantry of the advanced guard—

A consideration of these facts will show that the first position of the attacking guns is not, to any great extent, dependent on the power of the gun or the rifle, but that it *should be as near the enemy's position as practicable, provided it is not so near as to render possible an attack from a body of the enemy's infantry superior in strength to that of the guns and their escort combined.*

The nature of the ground has naturally a good deal to do with the matter. Artillery, to obtain good effect, must be brought into a position which combines as many as possible of the advantages mentioned before (Chap. VII.).

It would appear, then, that at a distance, *roughly judged*, of *a mile from the enemy's main defensive line*, the best ground available should be chosen for first coming into action. It seems a mistake to push much closer, because an enemy can from skirmishers sent out in front of his position maintain a destructive independent fire ; and if the guns have to keep down this fire they will necessarily be diverted from their proper mission, which is to subdue the hostile artillery. On the other hand, the fire of field guns at a range of a mile is very effective, and a distance of 200 or 300 yards either more or less makes little difference in the effect of their shells.

Effect of general's plan on position.—It is one of the main characteristics of the modern fight, that against a *good* defensive position a frontal attack of infantry is impossible unless aided by a very powerful fire from the artillery—a fire sufficient to subdue, to a great extent, both the artillery and infantry fire of the defence up to the decisive stages of the fight. To obtain such a fire from the limited number of guns attached to a division is not possible. Hence, with small forces, there will be made against a strong position an attack on the flank, with a feint against the front, or a combined front and flank attack.

When a position is not strong, and the ground to be advanced over is favourable to the attack, the main force may be directed against the front, the cavalry and reserve troops being prepared to act against the flank in case of success.

Whatever may be the plan of the general, it must be remembered that the front covered by the troops in their forward movement is limited by the numbers available. In the case of an English division, in the most extended formation there cannot be more than four battalions (including the advanced guard battalion) in front line. The actual space covered by the front of the attack will not exceed at the most 1,400 yards. As the front of attack is so limited it is evident that from a central position the fire of the guns can effectually aid the advance from either flank. In the case of small forces, then, the main position of the guns is always evident as soon as the general front of attack is made known. Whether the attack be made in one continuous line or with an interval to allow space for the guns, the position of the batteries should be as far as possible in the middle of the projected attack formation.

Description of an offensive action.—For the sake of clearness let us follow briefly the ordinary course of the attack of a division made against troops defending a position.

While the advanced guard action is going on, the general of the division forms his plan of attack. The result of his decision is at once made known to the officer commanding the artillery, who brings up his batteries as before mentioned. Orders are at once sent to the infantry on the march to deploy in the preparatory order for battle. The preliminary order for battle is in all armies the same, and consists of—

(1) A front line of battalion columns at deploying intervals.
(2) A second line of battalion columns.
(3) A reserve.

The actual forming up of the troops on the march on the head of the column will take some time, probably at least an hour. The assumption of the *rendezvous* formation does not imply that the head of the column should halt, but

The number of battalions in the front and second line are definitely stated, and the general line of advance of the whole or portions of the front line pointed out. While these movements are taking place the general will probably be with the advanced guard, taking position on some point where he can most effectively superintend the course of the action, and will point out clearly to the advanced guard leader the part he has to play.

As the advancing infantry come under the artillery fire of the enemy, which takes effect at some 2,000 to 2,500 yards, the front battalions assume the regulation attack formation. It is at this stage that the last definite orders can be given by the general in command as to the plan of attack of the leading battalions.

The fighting line of the first battalions with its supports and reserves (*vide* F. E. Part III. s. 42) presses forward, but without hurry or doubling, and, utilising all available cover, gradually comes up to and passes the guns in their first principal position.

The actual distance to which the first troops in open order are able to push forward depends on the character of the ground, and the amount of effective fire the enemy can bring to bear on it. The advance of the infantry should not, if possible, mask the fire of the guns. *The infantry should not be ordered to make its decisive advance until the artillery of the defence is to a considerable extent silenced.*

It will thus happen in all engagements that there is a temporary check, the front line of the attack lying down and utilising cover while the artillery duel is proceeding. In ordinary cases the reserves of the leading battalions will not pass the line of the guns.

The infantry of the advanced guard will generally at this period be somewhat further advanced.

Owing to the great extension of modern fighting formations the front line of attack is now absolutely committed to a definite task, and it is very difficult for it to make any but direct movements either in advance or retreat. The second line of battalions and the reserve are still well in hand, and can be shifted so as to prolong the line of attack or take ground to a flank.

The front line of the attack formation will inevitably be seen by the enemy, but the actual point against which the attack is intended to be pressed is not known, and to conceal the dispositions of the second line and reserves till the last possible moment should be the special care of the general.

Preparation for the attack.—When the commander of the division thinks that the enemy's guns are sufficiently subdued to admit of the infantry advancing he makes known the fact to the artillery commander, and points out the portion of the enemy's position against which the attack is to be delivered.

The fire of all the batteries *except one* is now converged upon the point of attack, and some little time is allowed for the fire to take effect. The actual delay at this period depends upon the manner in which the enemy is holding the position at the point threatened, and the apparent effect of the fire on his artillery and infantry in the vicinity. The remaining battery, which will for choice be that belonging to the advanced guard, should be directed to sweep the whole of the rest of the line of the enemy's guns, and prevent them shifting their position to meet the forthcoming attack.

Progress of the attack.—As soon as the attack is ordered, the leading battalions push forward rapidly without firing. The skirmishing lines come almost at once under the aimed fire of the infantry of the defence, and it is this fire that the artillery have now to subdue.

The *whole of the guns*, as soon as the advance is made, accordingly turn their fire on the *enemy's infantry* in the vicinity of the point of attack, and neglect for the time being the artillery.

Advance of the infantry.—The resisting power of the attacking troops will be subject to both the infantry and artillery fire of the defender. To this fire the guns of the attack alone have to reply, and hence the necessity of concentrating all the fire of the guns on the point of attack. The infantry pass forward as rapidly as possible without firing in such formations as enable them to advance with the least loss.

When the limits of the third zone are reached, when the aimed fire of the defending infantry becomes effective, which may be assumed to be at about 800 yards, the leading infantry find it more and more difficult to get forward. The skirmishers have to double and gain ground in advance by the short rushes of alternate small bodies, such as companies and half-companies ; as each small body halts a vigorous fire is opened on the enemy's infantry, and a further rush then made. As a natural result of the checking of the first line of attack, the supports and reserves of the line begin to close on the front, and, being in the fire-swept zone, have to split up in small columns and utilise cover as far as possible. Gradually the supporting line, as checks occur, comes up into the front line and increases its density and firing power. The reserve troops assuming a loose line formation quickly advance, and when the whole three lines are practically closed and form a dense mass of skirmishers, some 200 to 300 yards from the position, a rapid continuous fire is kept up for a few minutes, after which the whole advance in a charge and strive to establish themselves in the enemy's position.

The extended character of the attack formation, and the impossibility of officers remaining mounted under infantry fire, render control of the fighting line very difficult. Solid support of some kind is needed, and artillery is the only arm that can furnish it. The fluctuating nature of the infantry attack, and the consequent need of some stable support, are perhaps best understood by following the narrative of a regimental officer, who gives the subjoined characteristic picture of the conduct of his battalion at the battle of Woerth.

Example.—'When we came within range of the enemy's fire, the leading section of my company formed in skirmishing order, and the other two sections followed in close formation at a short distance. In front of us there was already a line of skirmishers. On arriving near the base of the hill (on which the French were posted) I saw the skirmishing line in front of me come down the hill at full speed, evidently, as I thought, followed by the enemy at their heels. I made my skirmishers halt, in order to detain the pursuing enemy to the utmost. When the repulsed skirmishers reached us and had halted, I learnt from a man—there was no officer at hand—that the French had attacked them with greatly superior numbers, and forced them to retire. We waited, however, in vain to see the enemy appear on the hill—no one came; there were only some of the enemy to be seen half-left in front of us about 500 paces off. Nevertheless the men fired all they could: I tried to prevent them as much as possible. Then there came along the line from the right a summons, given by signs from the officers, to endeavour to storm the heights. The whole line went up the hill with hurrahs and a fabulously rapid fire.

'Arrived above, we saw dense lines of the enemy's skirmishers, at a distance of about 400 paces, run away with the utmost rapidity and disappear behind the nearest wave of the ground.

'We followed as quickly as possible. Then suddenly the advance stopped, and our whole line turned round and ran away. The fact was that the French had made an attack with reinforced swarms of skirmishers which had repulsed our right wing.

'After about 200 paces we succeeded in bringing our line to a stand, and . . . . kept up uninterruptedly a very hot fire. We now again went forward after having calmed our men as much as possible. This time the French let us approach to within about 200 paces and then fired: it was a to press forward was impossible, and all sought cover. A long-fire fight now ensued. We then distinctly saw some French closed battalions approaching for attack. This was too much for our men. We did not actually run away, but the whole line went slowly back.

'We had already retired some 150 paces, when all at once we heard the bugle call for the "whole to advance."

'At the same moment we saw some closed battalions of Wurtemburgers approaching. This was sufficient to make all go forward with renewed life. We went against the enemy with ever-increasing speed. The French turned and then ran away.'[1]

Necessity for guns to advance.—Support to the infantry in the advance must be afforded by the guns, and the only way to give that support is for the artillery to accompany them up to the point where the infantry fire of the enemy becomes so deadly that it is impossible to bring the guns into action. It may be urged that from its first position the guns may, under certain circumstances, be able to fire up to the close of the action. This, however, will rarely be the case, as the infantry in its advance will, at some stage, mask the fire. Even, however, if the guns can continue firing, they should advance, if the ground permits of it, on account of the *moral effect.* A bold advance of guns dispirits the opposite side, while their immediate presence animates and strengthens the infantry in their time of need. The noise of the discharge, the violent explosion of the shells, and the steadiness of guns in action, combine to cause an effect on the courage and nerves of the soldiers, wholly incommensurate with the actual destruction caused.

Moreover, when guns are close at hand, they can participate with greater ease in the varying phases of an action, and turn their fire to aid a local success, or cover a retreat without any delay.

It may sometimes happen that an infantry advance is made over a valley, such as at the battle of Woerth, when the guns were unable to advance with the infantry, but could, from their first position, fire over their heads with safety; or a case may occur, as in attacking the Montretout redoubt where the ground is too broken to admit of the guns getting forward at all. In such cases the disadvantage of a position in rear becomes speedily apparent. At the most critical stage of the action the artillery have to cease firing, being unable to distinguish friend from foe.

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[1] *The Frontal Attack of Infantry.*—Newdigate.

Distance to which guns can advance.—There is no doubt that in the last few years the precision of the infantry arm has increased. It does not appear, however, that this will materially affect the distance from an enemy at which batteries can come into action. The disturbing influences of actual war render useless the calculations of the practice range; and in the case of a large target like a battery, a man who cannot hit one with a Chassepot rifle, is not likely to do so with a more modern one. There will, of course, be *exceptional* cases, where batteries have their *personnel* shot down at 1,000 and 1,200 yards.

The ordinary experience of warfare shows us that batteries can come into action, and remain in action, at a distance of, roughly speaking, 800 yards from an enemy's infantry. From every battle of the 1870 campaign can be drawn an instance. Among others may be cited the advance of two batteries up the Rotherberg at the battle of Spicheren, coming into action at 800 paces from a powerfully entrenched position. In the battle of Mars-la-Tour 'the advance of the French skirmishers from the Tronville copses was completely arrested by common shell at ranges of from 900 to 1,000 paces.'[1] At Gravelotte the attacking batteries were formed up at from 800 to 1,000 paces, when possible.

Undoubtedly this pushing forward of artillery subjects them to considerable loss, but guns can continue firing after battle to secure the common end of victory; and the forward position of batteries, though attended with risk, is absolutely necessary in order to efficiently aid the infantry attack.

The distance of the second artillery position will, of course, vary slightly, according to the ground. Cover may admit of guns being run up by hand to exceptionally close ranges. When the enemy's troops are much demoralised, or are of inferior quality, boldness in advance may be used with advantage, as was evidenced in the later phases of the Franco-German war, and more recently in Egypt by the horse artillery with General Lowe on the 28th August, and a portion of the field artillery at Tel-el-Kebir, where batteries passed over the parapets and cleared the trenches by their fire at close quarters.

Advance from first to second position.—As the infantry attack proceeds, the guns have then to advance from their first principal position, about one mile from the enemy, to a second position, some 800 yards from them. It will be rarely possible to make this advance all at once, and there will generally be an intermediate position.

There is no absolute rule as to the time when the advance should be made, as it will obviously depend upon the course of the fight, the facility with which the attack progresses, and the extent to which the guns become masked.

As a general rule, it may be laid down that the advance from the first position will take place when the reserves of the leading battalions pass the guns, and that the point moved to will be a little in advance of the leading skirmishers. It will occasionally happen that the advance of the skirmishing line forces the guns to cease firing. In such a case they should limber up and advance ahead of them, the movement being covered by any guns which can still continue in action.

A change of position thus made, which should be *at the least* 500 yards in advance, will bring the guns about halfway between the first and second artillery positions. A similar advance forward is made from the intermediate to the second artillery position.

The assault.—From the second position some 800 yards from the enemy's line a heavy fire is directed on the point of attack. Those guns whose fire is masked, turn their attention on the reserves or any fresh guns coming into action. It will sometimes happen that at this critical period of the infantry fight the batteries have to cease firing, owing to their inability to distinguish friend from foe. All moments of delay should be used in filling up the limbers with ammunition. In small actions the artillery will sometimes be able to limber up and come into action on a flank. The great principle is that all arms should unite in striking the final blow.

A success.—When the attack is successful, and the leading infantry have turned the enemy out of his front line, half the batteries should at once go forward to the position taken, and come into action to protect the attacking troops from counter-assault from the enemy's reserves. The batteries already in action cover of course the movement as far as possible with their fire.

At this stage there may be a temporary check, and the infantry may be at points driven back. The advancing batteries, if they have not arrived in their new position, *come into action* where they are, and thus afford support.

When the infantry are firmly established in the enemy's lines the rest of the guns at once advance forward.

It will thus be seen that it is the duty of a portion of the guns to advance in close support of the infantry while the remainder holds its ground, prepared either to advance in case of success, or cover the retreat in case of a check.

It will frequently happen in the case of small forces that an advance forward of the guns is unnecessary, and that they will be able to play their part effectively from the second artillery position, till the result of the action is in one way or the other decided.

the infantry and artillery arm so close, that but little latitude of choice is possible.

In choosing the first position, a commander should treat as an essential the ability to powerfully counter-batter the guns of the defence and then protect his *personnel* and waggons as much as possible.

The movements of the infantry in the preparatory attack are dependent on the guns. When, therefore, there is ground favourable and also unfavourable to the infantry, that flank of the advance guard battery should be chosen for deployment which will least hamper the infantry in their forward movement.

In taking up an intermediate and second position, all considerations must give way to the one object of accompanying and aiding the advance of the infantry.

In the latter positions the guns have as a rule to fire against some decisive points and mainly against infantry. To have a clear range is about the only advantage that is likely to be easily obtained.

General duties of artillery commander.—The commander of the artillery, as before related, accompanies the general of the division in his preliminary reconnaissance, and will be a spectator of the advanced guard action. He will be told as much of the probable plan of the battle as possible, and have first pointed out to him *the flank of the advanced guard* up to which he has to bring his batteries.

The artillery commander has then to rapidly reconnoitre and choose the actual position, at the same time sending one of his staff to bring up the batteries. As a matter of principle, the senior artillery officer should receive the batteries in their positions and stop with them during the course of the fight.

It is, however, of the greatest advantage that there should be complete accord in the conduct of the battle, and, therefore, from time to time instructions from the general should, if possible, be received. If these cannot be procured without leaving the guns they must temporarily be left in charge of the next senior officer.

Information on the following points should be sought for :—

1. The *time* when the fighting position should be taken up.
2. The general line of advance of the infantry.
3. When the infantry commences its real attack.
4. When the fire of the guns is to be turned on the object of the assault.

When the general does not give his orders on these points, the artillery leader acts on his own responsibility in carrying out the different movements at proper times.

In reconnoitring the first position to be taken up, the commander must see that sufficient support is afforded by the troops of the advanced guard. The ranges of all conspicuous objects should be learnt from the advanced guard battery and noted down on paper. The range-finding party already on the ground are set at work to gain any additional information which appears necessary.

It will be rarely possible to examine more than by view the ground in front, but the ground in rear over which the batteries have to advance should be carefully scanned by the *officer sent back with* the order to advance.

In all cases of changing position the commander should go forward at the gallop and examine the position, and be ready to receive the batteries as they come up.

Advance of the batteries.—The divisional artillery will naturally be on the roads or lines of approach in column of route at the commencement of the advanced guard action. As soon as the fight commences, the batteries should form up on the side of the road, not necessarily halting, but assembling, to await the order to advance and come into action. This movement should be effected out of range of the enemy's guns.

At this time the batteries subdivide if they have not done

Into position.—It has only to be remembered that the advance of the batteries, when coming into action, should *be in line at full interval,* and that, therefore, each battery should be formed so that the whole may form line without difficulty. Generally speaking, columns of half-batteries or of divisions is advisable, with as nearly full interval between batteries as the ground will permit of.

The batteries advance in line at the trot when the order arrives and *come into action simultaneously* on one flank of the advanced guard. By so doing, there is less danger from the enemy's fire. The advanced guard battery has already got the range, or, if it has not, the range should have been previously determined by a range-finding party sent forward.

The commanding officer of artillery either rides back to the batteries and himself leads them into position, or gives the order for the flank battery to form on a pivot pointed out by him.

The chief cases in which the divisional artillery should come piecemeal into action are when the advanced guard is much pressed, and the delay of a few minutes, caused by deploying, cannot be permitted; or, when guns have to come rapidly into action out of a defile. In such cases an endeavour should be made not to bring less than one battery into action at a time.

Changing position.—All changes of position, when made under the effective fire of an enemy, must be in échelon; the major portion of the guns advancing from one wing or the other under cover of the fire of those in action.

When the infantry are advancing forward, as would always happen when the guns are preparing to advance from their first fighting to an intermediate position, *the échelon nearest the infantry* will first advance.

In the latter portion of the fight, when the musketry fire increases in intensity, and the advance is slow and at times checked, that échelon advances which is *suffering the most from the enemy's fire.*

Marching formations.—In coming into action and changing position, the greatest celerity is required. Advances will rarely be made for less than 500 or more than 800 yards, hence it is not too much to expect extra pace from the horses The *utmost pace* should be got out of field batteries consistent with keeping the battery well in hand. Unlike cavalry, the horses of field artillery rest when the men and guns are in action; therefore, rapid movement to the position does not at all unfit the batteries for combat. The lateral dispersion of an enemy's shell is small, and the effect of both shell and bullets great with regard to the length covered by the projectile. Hence, all deep formations should be avoided.

When the ground admits of it, line at full interval should be used. When the ground is at all obstructed, or when the advance is not made directly, forward columns of divisions are most handy. In the case, which not unfrequently occurs, of being able to bring up a battery by a flank movement behind the crest of the slope upon which they are to come into action, columns of sections should be used. The guns can then be rapidly brought into action to a flank, or if the ground admits of it, run up by hand. It is worth while to remember that in all movements under fire *roads should not be used.* The columns on roads must be necessarily deep; the ranges to all parts of them are probably known to the enemy, and they had better be left to the ambulance waggons, supply carriages, and the impedimenta following the division.

The majors commanding batteries should, in advancing, be about 200 yards ahead of them, so as to note and avoid any obstacles of the ground.

Fire discipline.—All the details as to fire discipline are carried out by the battery commanders upon the principles before laid down. There remains to be considered the method by which the fire of several batteries may be made effective fire, that the range and effect of the shells should be correctly judged. When several batteries are firing at a similar object, confusion arises, as it is impossible to distinguish the bursting of one shell from another. Again, the smoke caused by the discharge of some of the guns will inevitably impede the fire and hinder the observations from the others.

In ordinary cases, the artillery commander will have ascertained the range before the batteries come into action, and will acquaint the battery commanders with it. The latter then regulate the fire of their batteries. When, however, the range has to be ascertained by trial shots, and when the object aimed at is so small as to render observation of single shell difficult, the artillery commander orders one battery to give the range, which will, for choice, be that on the leeward flank.

When the smoke proves inconvenient, the order can be given either for a part of the batteries to cease firing till it clears, or for a slower fire in order to clear the front (in the case of the wind blowing towards the front of the battery), or for the fire to commence at one flank of the division.

Nature of fire.—The officer in command will also give orders as to the projectile to be used. Putting aside case as a missile to be only employed in self-defence at close quarters, we have to consider when common and shrapnel shell are used.

At some not distant date there will probably exist a shell of the shrapnel type which possesses both a percussion and time fuse, and which will be employed on nearly all occasions. With our present equipment, however, the use of the two kinds of shells is distinct, and is, for the sake of clearness, kept separate. *Common shell will always be used in determining the range*, and at distances *exceeding 2,500 yards*, so long as the present guns are retained.

In the first fighting position, and the intermediate one in advance, the range, if necessary, is found with common shell, which is at once changed for shrapnel. In the more advanced artillery position, shrapnel should be used from the first.

When guns are strongly entrenched, or troops are behin walls or obstacles, common shell can continue to be used When friendly troops are crossing the front of fire, and in al cases of firing over the heads of troops, invariably employ common shell.

Shrapnel, as has been stated, is the projectile of the future, and should always be used when practicable. When, from any cause, such as being exposed to a heavy fire, or having to aim at a moving object, the accuracy of adjustment of the time fuse cannot be depended on, use shrapnel with percussion fuse.

In firing from a large number of guns with shrapnel shell, it will be advisable that each battery regulates its fire so as to cover some 200 yards in depth of the enemy's position. A portion of the enemy's line will generally be concealed from view, and by directing the whole of the fire on the front line, the supporting troops escape all but the badly aimed shell.

The conduct of the fire of the divisional groups of batteries is here dealt with, but it must be remembered that in the generality of cases the independent action of the advanced guard battery ceases when the division of guns reaches its first fighting position. The advanced guard battery falls naturally into the command of the senior officer of artillery except in *special* cases, when an advanced guard *continues to play an independent part.*

Rapidity of fire.—The general regulation of the fire in accordance with varying ranges and observed effects is the duty of the battery leader. The rate of firing is, however, ordered by the commander of the whole, and he has to deside when the fire shall be slow and when rapid.

In ordinary cases, in the preliminary combat, and during the artillery duel, the fire should be slow. To fire rapidly during the whole of an action is impossible, [redacted]

(1) Masses of the enemy are moving within effective range.

(2) Artillery is in movement or coming into action.

(3) The decisive infantry attack is about to take place, and during any critical situation when the advance is being checked.

(4) Guns have to act in self-defence at short range.

(5) One échelon of guns has to move forward under cover of the fire of those still in action.

The object to be fired at.—The next important duty of the artillery commander is to fix the target at which each battery should fire.

During the first part of an engagement the fire of a line of the enemy's guns has first to be subdued. The line, if continuous, is divided into as many parts as there are batteries in the attack, and each battery is told off to its portion of the line, which should be that the most nearly opposite to it. When slow, accurate fire has had some effect, the fire of two batteries may be turned first on one section and then, after silencing that portion of the enemy's line, upon another.

When the batteries of the enemy are separated, the fire of *two* batteries of the attack should, as a rule, be directed against one of the defence until it is silenced, when they turn upon another.

When an enemy has only one battery in action, a concentrated fire should speedily destroy its *personnel*. If there are two hostile batteries, one of the divisional batteries should join in with the advanced guard battery against the one it has originally been firing at, while the remainder of the batteries come into action against the other.

In all long range firing it will be very advantageous if a post of observation is taken up some 300 yards to the front of one of the flanks.

When an advance is made from the first principal position to one more in front, the first échelon of guns has to estimate the range. This will be known approximately, as the distance advanced over can be judged. To estimate it, however, by trial shots, it will be advisable to fire a salvo of from three to six guns at the estimated elevation. No time is to be lost, and the bursting of a single shell may be difficult to see when there is much firing. The Russian regulations advise that, in order to lose no time, the guns should be loaded before the advance is made. This can only be done with breechloaders.

In the intermediate and final positions of the artillery, as soon as the range is determined, *concentration of fire* becomes a necessity. The whole of the guns will have to be turned on the decisive point against which the attack is directed, or against the infantry or artillery that are impeding the advance.

When batteries of the defence are still troublesome, fire should be directed on one after another, and the *most exposed battery*, or that least protected, should be *silenced first*. In all other cases of concentration of fire it is not necessary to do more than to point out the whole of the object aimed at to each battery commander, who covers the entire space with shrapnel fire, the fuses being given a slightly varying adjustment.

Woods.—If the enemy occupies in force a wood or other portion of ground where he is unseen, the usual habit is to divide that ground into portions and assign one section to each battery. By such means the German artillery at Sedan, unsupported, and with its back to the Belgian frontier, held at bay a great French force which attempted to break out northwards. Artillery officers should have a thorough knowledge of general tactics in order to judge what the enemy is likely to attempt, and what part of the hidden area he is probably occupying.

Supply of ammunition.—The manner in which batteries obtain their ammunition from the waggons has already been

16-pounder and seventy-six for the 9-pounder guns, as well as thirty rounds of small arm ammunition for each infantry soldier. The gun ammunition is carried partly in the ordinary ammunition waggons and partly in wooden boxes packed in ammunition and store waggons. For matter of convenience in supply each column is subdivided as follows :—

No. 1 Subdivision	6	16-pounder ammunition waggons.
	6	9-pounder ,, ,,
	10	Small-arm ammunition carts.
	1	Rocket waggon.
	23	Carriages.
No. 2 Subdivision	12	Small-arm ammunition carts.
	8	16-pounder ammunition and store waggons.
	2	9-pounder ,, ,,
	2	Spare gun-carriages.
	1	Forge waggon.
	3	Store waggons.
	28	Carriages.

Position.—The proper position for the divisional reserve when troops are engaged is out of fire some one or two miles in rear of the centre of the troops it supplies. It will be posted under the direction of the general officer commanding by the officer commanding the divisional artillery, who will make proper arrangements for its command and safety. It is an advantage to be near some conspicuous object, and the communications to the front in every direction should be as open as possible.

Reserves should be posted clear of all roads, paths, or lines of advance.

The senior artillery officer will make known the exact position of the reserve to all the battery leaders, and also to the infantry brigades. In the event of any change being made he will at once acquaint, by means of orderlies, all officers concerned.

The supply of ammunition in the field has always been a point of the utmost importance, and it is now even more so than ever, owing to the great expenditure in the modern fight. Napoleon, writing to Berthier after the battle of Montereau, in complaining of the ammunition reserves being kept too far to the rear, stated that an artillery officer who caused the supply of ammunition to fall short in a battle merited the punishment of death.

Duty of commander.—The field officer in command of the reserve, after the position has been pointed out to him, will be responsible that every facility is afforded for sending supplies to the front. He should keep himself informed of every change in the action and movement of the troops. The lines of communication between the reserves and the troops in front, and also that leading to the army corps reserve in rear, should be carefully reconnoitred. Wherever there is likely to be any difficulty in finding the roads of approach to the reserve, mounted men should be sent out and posted so as to act as guides. In addition a good look-out should be kept at the reserve itself.

The position of the reserve must not be shifted except by order of the artillery officer in chief command. The commander can, however, use his discretion with regard to the manner in which the waggons are packed, and also as to separately locating the two subdivisions.

Supplying ammunition.—When empty carts and waggons come from the front to obtain ammunition they should always, if *time admits of it*, be filled from No. 2 subdivision. The whole of No. 1 subdivision should be kept full ready to be sent to the front in cases of emergency. When the artillery waggons of No. 1 subdivision are obliged to be sent to the front, the empty battery waggons are in the meanwhile filled from the ammunition and store waggons of No. 2 subdivision and sent back to their batteries, the waggons belonging to the reserve returning back to it when replaced at the batteries.

Whenever ammunition is supplied a receipt should be taken. It is the duty of the reserve commander to, as far as possible, keep his waggons full, and hence every opportunity should be taken to fill up the waggons when empty from the army corps reserves.

Army corps reserve.—The general army corps reserve is organised in three sections, each carrying a full supply for a division in ammunition and store waggons. This arrangement admits of the general reserve being disposed in three distinct columns, each following a divisional reserve, or the whole may be massed together as the general officer in command may order.

Position.—The reserve follows the general movements of the army corps, and would generally be a short day's march in rear of the fighting line. Constant communication should be kept up between the divisional and corps reserves, and any changes in position be at once made known. In the case of a heavily contested action, when the divisional reserves are likely to have a serious call upon them, it will generally be advisable to advance a portion of the general reserve halfway towards the position of the former, so that its waggons may be more quickly filled.

When halted the general reserve should be parked close to the side of a road, but quite clear of it. The position of the reserve is always known to, and determined by, the general in chief command acting in conjunction with the brigadier in charge of the artillery.

Replenishment of ammunition.—Although the empty waggons of the divisional reserve will, as a rule, be filled up and sent back, yet when time presses, filled waggons should be without hesitation at once sent forward, and subsequently rejoin their own column. In addition to the two reserve columns in charge of the artillery, there will also be at the base of operations, and at intermediate depôts, a third reserve of 200 rounds per gun in charge of the Ordnance Store Department. Ammunition will be issued from this to fill up the sections of the columns upon requisition by the officer in command of the artillery, and in time of emergency upon demand by the officers commanding the columns.

The ammunition carried for the use of an army in the field will therefore be divided as follows :—

	Rounds of ammunition		
	Per each gun		Small arm for each rifle
	9-pr.	16-pr.	
In possession of troops . .	148	100	70
Regimental reserves . .	—	—	30
Divisional reserves . . .	76	90	30
Army corps reserve . .	76	90	30
Army reserve under charge of Ordnance Store Department	200	200	320
Total . .	500	480	480

CHAPTER XI.

THE ATTACK OF AN ARMY CORPS.

Preliminary—Exceptional action of strong advanced guards—The advanced guard of a large force—The general position—Place of the guns—Advance of divisional artillery—Advance of corps artillery—No reserves—Case of a single advanced guard—Advance of guns—Forming of groups—The reconnoitring position—Method of advance—Question of command—Escorts—Changes of position—Effect of guns—Smoke—Fire-discipline—Preparations for assault—Assault—Frontal attack—Advance of batteries—Second position—Flank attack—Advance of batteries—The decision.

Preliminary.—In the case of a large force, such as a corps d'armée advancing against an enemy, it would in general be preceded by a strong force of cavalry and horse artillery. Under ordinary circumstances an enemy would oppose a force of similar character, and the result would be either a great cavalry battle or a series of local fights, in which the action taken by the horse artillery would have a distinctive character of its own (Chap. XIII.).

As the approaching forces come closer to one another, a time will arrive when, of necessity, the cavalry have to clear away from the front. If the cavalry of the attacking force prove itself the strongest, it will in general be able to push on till the enemy's infantry outlying detachments be met with, and will be able to gain information as to his movements. The advanced guards following up would virtually meet with no resistance till they came up with the detached posts covering the position upon which a stand is about to be made.

On the other hand, if the forward movement of the cavalry is checked from any cause, the duty of supporting them, and pushing back hostile detachments, or gaining information, mainly falls on the advanced guard, and will entail its engaging in a series of local combats in which the greatest boldness should be shown by the attacking force. Eventually the advanced guard comes into the vicinity of the enemy's main position, and its ordinary tactics (Chap. IX.) come into play.

Exceptional action of strong advanced guards.—When large forces are concerned, there will arise cases in which exceptional modes of action must be followed by the advanced guards, and in these cases, as a rule, the artillery play a most prominent part.

As an example we may take the battle of Sedan. Here, *before the march* of the advanced guard of the left of the German army began, the situation of the enemy was known, and it was evident that promptitude would enable a force superior in numbers to surround them. The only arm which could with sufficient promptitude cut off the French retreat was artillery, and hence we find that with the artillery of the advanced guard went forward the whole of the available guns of the eleventh and fifth corps d'armée, and they came into action on the heights above Floing. A double object was thus gained; the French retreat towards Mezières was cut off, and the march of the slower moving infantry through the dangerous defile south of the Falizette wood covered. The movement undoubtedly entailed risk, but the object to be gained was worth it, and the large number of guns brought into action rendered their defensive power very great.

We may take, again, the case of an army surrounded, which is endeavouring to break through the circle of investment, as at Metz and Plevna. Here it is obvious that surprise is one of the essentials to success. The ordinary reconnoitring or delaying action of an advanced guard would serve mander of an advanced guard finds himself confronted by an unexpected aspect of affairs. A fleeting opportunity appears before him of gaining a great success. Time will not admit of waiting for the main body to come up, nor asking the sanction of the general in command. An attack, if made, must be carried out with great boldness, and a heavy responsibility incurred. As an example of this class of action, we may instance the commencement of the battles of Spicheren, Colombey, Beaumont, and Rezonville. The position of the advanced guard will be for a time dangerous and its batteries exposed. By the immediate detachment from the main body of all the available guns, ground can be held until the success of the improvised action is secured.

The advantages gained are generally doubtful. Success may, in a sense, be attained, but as a rule it will be more complete if carried out by the main body acting as a whole, instead of serving as a piecemeal reinforcement to an advanced guard leader.

The general tactics of an advanced guard have already been discussed; it only remains to be considered how the matter is affected by large forces being concerned.

Advanced guard of a large force.—An army corps with its three divisions and seventeen batteries would most advantageously advance by three roads. Where communications are rare it might be forced to adhere to one road. Whatever form of march be adopted, the divisional artillery will be placed close behind the head of their divisions, while the corps artillery (five to eight batteries) would not be further to the rear than behind a leading division.

The triple organisation of an English army corps does not lend itself easily to the higher artillery tactics. If it be remembered, however, that the front of attack of a corps does not exceed some 4,500 yards, that in close country more than two available roads would rarely lead to the point of attack, and that the artillery, for the purpose of command, must not be unnecessarily divided, we may fairly conclude that the divisional artillery would, before arriving on the battle-field, be in one, or at most, two columns. In very open country, where the order of march is not restricted, the batteries of the divisions would be undoubtedly massed, and the whole corps would be covered by one advanced guard, of a strength not less than a brigade of infantry and two batteries, with the cavalry available. In close country the attacking force may possibly be kept divided before deployment, and would be covered on each line of advance by a separate advanced guard.

The question may be fairly summed up as follows :—A large united advanced guard covers the advance, if made on one road, or if made in open country. In advancing in close country, or when the number of troops is great, two advanced guards would generally march side by side, covering their respective columns. In both these cases the general tactics of the advanced guard would be identical with that already laid down. A bold advance drives in the outlying posts, and is carried on until the main force of the enemy is met with. The artillery then comes into action against the advanced posts of the enemy's line, and, if circumstances allow of it, try to draw the fire of the guns in the main position so as to gain information as to the manner in which it is held.

Where large forces are in question, it would appear that the whole of the preliminary fighting falls on the advanced guards, and more especially occupies the guns. Hence great care should be taken not to fire unnecessarily, and to husband ammunition as much as possible.

General position.—The actual position on which the advanced guard guns should finally come into action is generally better defined than in the case of a small force. The enemy will have had time to choose ground advantageous to himself, and the *first fighting position* of the artillery of the attack will be at such a distance from the defensive line that the advanced batteries should have little difficulty in attaining it at once.

batteries coming into action at less than 2,500 yards from the guns of the defence. At the battle of Loftcha, again, the ridge dominating the main Turkish defences pointed out the main position for the attacking guns.

In further considering the position of the advanced guard artillery, the manner in which an enemy occupies a position must be remembered. In front of his line, almost always on his flanks and occasionally in the centre, would be advanced posts, which have first to be driven in. Against these advanced posts the fire of the guns would be in the first place directed.

The great range of modern guns, and the greater efficacy of enfilade over direct fire, render it a matter of little moment for the advanced guard batteries to deploy directly in front of these posts. But, on the other hand, the slowness of movement of the advanced guard infantry makes it advisable that they should move by the shortest road directly towards their point of attack.

It may be presumed that an attack implies a superiority in force, and that in all modern fights there will be a general attack along the whole front, while a turning movement is made on one or both flanks. All modern battles, again, are commenced by a long preliminary artillery duel, in which every available space for a gun opposite the defensive line will have to be utilised. In order to cover the turning movement, it is evident that the enemy's flanks are the points where it is a primary necessity to drive in his advanced posts. The engaging of the centre of his line is a secondary matter which may, with advantage, be left to the batteries of the main body which come up later on the ground. As a result of these considerations, it would appear advisable, as far as the nature of the ground admits of it, to deploy each of the two advanced guards in front of the extremities of the enemy's line. The interval between them can be effectually filled by the batteries subsequently coming up; the deployment of the main body is better covered, and the carrying out of the flanking movement concealed to the last moment.

Position of batteries.—Assuming, then, that the two advanced guards of the attacking army corps are led as far as possible into position, opposite the estimated ends of the enemy's line, the batteries will come into action on one side or other of their lines of advance, according as the ground affords opportunities. The outer flanks of the batteries can be protected by the cavalry which has had to clear away from the front, and the immediate support comes from the infantry of the advanced guards.

In an engagement where large forces are concerned, however, it will be rare that the advanced guard unsupported can drive in any strong advanced post, and they will have, as a rule, to fight a delaying and possibly defensive action. Hence we may lay down that the battery leaders should attentively consider the best line for the infantry advance, and arrange that when deployed the batteries of the advanced guards should *be on the outer flanks.*

Advance of divisional batteries.—It has been pointed out before, that when there are two columns of advance the divisional artillery will march behind the leading battalion of the columns. The batteries of the divisions in front will form the first reinforcement to the advanced guards. Whether the batteries of the third division keep with their own troops or are formed up with the division leading, is a matter which rests with the general in chief command. It does not materially affect the theory of the artillery attack, but rather raises the question of the necessity of keeping guns in reserve.

The divisional batteries advance and come into action on the *outer flanks* of the advanced guard guns. There appear several advantages in so doing. In the first place, there is more room given for the corps artillery to come into action in the centre of the attack. It should be remembered that on the modern battle-field there is generally a difficulty in liable to be masked, and give more effective support than if placed on the other side of the advanced guard battery.

It may possibly happen that the interval between the advanced guards is so great that it is best to fill it up partially by deploying the divisional batteries on the interior flanks, in order to avoid the risk of a sudden forward movement of the enemy. This, however, will rarely be the case. The whole army corps is gradually advancing, and the corps batteries will, in point of time, not be much behind the others.

The general position of affairs at this stage is shown in the sketch (Pl. XI.). The advanced guard batteries, strengthened by those of their own division, are in action protected on their inner flank by the advanced guard infantry, on the outer by cavalry. The main body of the divisional troops is advancing and deploying in *rendezvous* formation in the rear, and has not yet been given the orders for attack.

The general in command would, during the combat of the advanced guard, have made his plans for the attack, and behind the position taken up by the guns and well out of the enemy's range, would be massing his battalions. The deployment of the infantry, firstly into column from the order of march, next its transference to the line of its subsequent advance, and thirdly its forming up for attack, requires considerable time. Again, the attack of the infantry must not take place till the guns of the defence are partially silenced.

Advance of corps artillery.—In order to lose no time in commencing the artillery duel, and also to fill up the space between the two advanced guards and thus form a veil to cover the deployment, the whole of the remaining guns of the corps must be at once pushed forward into action. In the advance, on two roads, of an English army corps it is evident that on one road there would be one division, on the other, two. It has been suggested that the whole of the divisional artillery should be kept close to the head of each column, and that the corps artillery should be somewhat more to the rear on one of the lines of advance. Whether this arrangement be carried out or not makes little difference in principle. The batteries leading the columns form up on the advance guards, and the whole of the remaining artillery force deploys between them.

It is evident that the guns of the division in rear are thus taken away from it, and act either with those of the leading divisions or with the corps artillery.

The taking away the guns from the hand of the divisional leader is an essential feature of modern artillery tactics. It is advisable, for the purpose of marching, camping, and supply, that the divisional group should be kept with its infantry. For the fighting of an army corps, however, everything must be sacrificed to obtain an effective line of guns in the *first fighting position.*

As the attack progresses it is desirable that the divisional infantry and its batteries should follow the same line of advance, but it is not essential.

The forward movement of artillery from its first position must be directed by the general in chief command through the artillery commanders. The artillery, in fact, in a great battle must act as an independent arm, and when once brought together must work in masses untrammelled by any question of what division particular batteries may belong to.

No reserves.—To break down the enemy's resisting power is the first task of the attacking guns. They, therefore, cannot be too numerous if there is sufficient space for them to come into action. The advisability of a reserve of guns is a moot question when large armies are in the field, but there is no doubt that in the case of a force like an army corps every available gun should be at once pushed to the front.

A single advance guard.—The case of an army corps covered in its march by one large advanced guard must now be considered. The general system of procedure is the same. The advanced guard pushes back the light troops of the enemy until it is brought to a stand-still by the resistance offered by a defensive position. With a force of considerable strength, such as a brigade of infantry and two batteries, a delaying action at long range can be kept up till reinforcements arrive. The actual position taken up will depend entirely on the line of advance, and will be at some point in front of the enemy's position. The batteries massed together come into action on the most favourable ground close to the side of the line of approach.

The position of the guns being thus fixed, the general plan of attack is determined, and reinforcements hurried forward to form the main line of guns, which has to cover the deployment. The first guns to arrive on the field are naturally those belonging to the division in front which has furnished the advanced guard. These guns form up on the flank of those in action, and thus re-form the divisional unit. Generally speaking, the flank opposite that on which the advanced guard infantry is placed would be chosen as affording a clearer range to the front.

Advance of corps artillery.—In determining how the remainder of the artillery force, the corps artillery, and that of the other divisions, should take position, the following considerations should be weighed.

An attack in front, as has been stated before, is invariably followed by an endeavour to turn one or both flanks. It may be assumed that an army corps in any general engagement would be unable to turn more than one flank. The flank to be turned would be decided on during the course of the advanced guard action. It would be a mistake not to conceal the projected movement till the last moment. Again, the enemy's guns along the whole of the defensive line have to be temporarily silenced, and his attention occupied by partial attacks in order to prevent him at once shifting troops to meet the flanking movement.

It results from this, that the enemy must be attacked along the whole of his front, and that no attempt should be made to move guns to a flank until the infantry which is to make the decisive flank attack is ready to advance. At the same time the great mass of the guns should be placed opposite that end of the defensive position which it is intended to turn. A deployment thus made will enable them not only to enfilade the enemy's line, when his troops form up to meet the flank attack, but also will allow of batteries following up the attack with comparatively little loss of time.

The artillery position to be taken up will be then a purely frontal one, and the *length of it* will be determined by the extent of the enemy's line. In all ordinary cases the amount of ground to be covered would be far greater than could be occupied by a continuous line of guns.

Forming of groups.—To engage the enemy along the whole of his front and at the same time to preserve the principle of *massing* guns as far as possible necessitates a division of the guns into groups. The actual size of the groups will depend much on the nature of the ground and the space not taken up by woods or other obstacles. In forming these masses, care must be taken not to interfere with the command of the lieutenant-colonels of artillery, and the three batteries of an artillery division should be always together. Two or three divisions are massed where space admits of it, and as powerful a group as possible formed opposite the end of the enemy's line it is eventually intended to turn. With a force of seventeen batteries two or not more than three groups are desirable. The practical application of these views would appear to be that, when the ground admits of it, one division of three batteries should form up on the advanced guard, while the corps artillery should keep together and come into action against either the centre or the manœuvring flank, if the advanced guard is not opposite it. The remaining five batteries (including the horse artillery) form a third group, in front of the remaining portion of the defensive line.

In the forming of these artillery masses it must be remembered that the artillery duel occupies some hours, and that the defence of the guns during that time is mainly entrusted to an infantry force whose position and movements ground. Where large forces are concerned, there is often a difficulty in driving in the whole of the advanced posts, a task beyond the powers of an unaided advanced guard. Thus the first deployment of guns will generally be at long range. The corps and divisional artillery as they advance will not always be able to form up on the same front as the advanced guard, but may have first to force back the prominent advanced posts of an enemy. Whether this be in any case a necessity or not, a time arrives in which the whole of the guns are in line in their *first fighting position*, disposed in masses at a distance roughly speaking of a mile from the enemy's main defences.

The advance into position.—When a large number of batteries have to be brought from the order of march into position considerable difficulties arise. The quickest method would naturally be, that each battery should in succession form up and get by the shortest route into the nearest available position. To come piecemeal under fire would be a great mistake, and allow of the enemy concentrating a large number of guns on each battery as it came into action. Again, the supply of ammunition would become very complicated if each battery had its second line of waggons kept separate.

The principle should be observed that, as far as possible, batteries should come into the fighting position simultaneously. To effect this, each division must quit the line of march and deploy in column prior to making the advance into action. The method to be followed by the divisional units has already been pointed out, but in the case of an army corps the following modification should be made. The *whole division* should clear the line of march together, the waggons forming up in rear of their own batteries. The formation, depending on the space available, will be columns of batteries or half-batteries, or columns of divisions. The latter is a preferable formation.

Before the order for advance is given, an officer, not under the rank of captain, is told off to command the *massed* second line of waggons. The first échelons of batteries then move forward, the guns deploying into line at full interval, and advancing straight to their front into the position to be taken up. The second line of waggons follows up and takes post in a sheltered spot in rear of the division.

In the case of the corps artillery, or where two divisions are intended to form a group, the divisions form up side by side in as open formation as the ground will permit. If possible the whole group, having formed beyond the enemy's fire directly behind the position to be taken up, then advances forward, the artillery commander naming a flank battery of direction by the front of which the others should dress. The second lines of waggons form as before, each divisional unit being kept separate.

It will rarely be possible for any large number of batteries to come into action simultaneously, on account of the space they require in their forward movement. In ordinary cases the artillery divisions will have to form up successively on the guns already in action, but it must be clearly understood that the division of three batteries is the unit of the battlefield, and should never be subdivided if possible.

The question of command.—The effective massing of guns, the regulation of their fire, and the supply of ammunition from the reserves are matters which can only be properly carried out by a regular system of command. In general charge of the whole artillery of a corps would be a brigadier-general, who would be on the headquarter staff, and who would be responsible for the proper tactical use of the artillery to the general commanding. In charge of the three batteries of each division would be the lieutenant-colonels, who would under ordinary circumstances receive their orders from the general commanding their division.

In the event of an attack by the whole army corps it will often be necessary for the brigadier to give orders direct to the

The officer in charge of the advanced guard force brings his batteries into action and carries out the task allotted to him.

While the advanced guard action is going on, the general in chief appears upon the scene and orders the attack to be carried out in a definite manner. This necessitates the advance of the whole of the artillery into a frontal fighting position. The actual place of the various batteries can only as yet be generally determined, but approximately the situation of each division, whether separate or massed, can be judged. One point will be at once clear, that is, the general length of the enemy's line opposite to which the batteries have to form up, and on which side of the advanced guard troops they must deploy.

The lieutenant-colonel who is with the batteries of the advanced guard will get instructions to reinforce his command with the remaining guns of his division (Chap. X.), and unless special orders arrive from head-quarters to the contrary, will be informed that his division will henceforward form part of the main artillery line.

The brigadier will have then, by means of his staff, to communicate with the other divisions and the corps artillery The orders sent should make clear the line of advance of each division, and if groups of divisions are made, they should be formed up in column before advancing. While the orders are being sent and the divisions are deploying from the order of march, the brigadier has an opportunity of riding near to and reconnoitring the positions to be taken up.

On the other hand, as soon as a division or two divisions are deploying, the actual work of superintending the forming up is left to the second senior officer, and the senior lieutenant-colonel gallops at once forward to the brigadier to hear his final instructions about the position, and also to see it for himself. As the batteries advance he goes back to meet them, and personally leads them into action. The officer in command of the corps artillery acts in a similar manner.

When the whole line of guns is formed, the brigadier establishes himself in the best position from which he can see the different groups of batteries, and from it he should rarely move. The colonels commanding each group of massed batteries would be kept in constant communication with him, and would themselves be posted where they can best regulate the fire of the guns in their command.

Escorts.—The divisions of artillery virtually deploy, in the first instance, on the advanced guard already in position. The flanks of that position are protected by the cavalry, which the immediate presence of the enemy's infantry has forced to fall back. The general-in-chief will have to determine if this force is sufficient to protect the advancing guns and secure their flanks when in action. If it is not strong enough, or if the enemy's skirmishers have become aggressive, an infantry support must be ordered up from the nearest troops. In addition to this precaution, each leader of a division must take all the usual steps in reconnoitring the ground passed over and also the *terrain* in front of his guns when in action. When in any way isolated the protection of a squadron of divisional cavalry should be asked for as a temporary measure from the general commanding his infantry division. These arrangements to ensure the effective action of guns in their first position have a tendency, as it has been observed, to take the guns away from the command of the divisional generals. The advantage of batteries being able to work with their own infantry, assist them in the fight, and look to them for support, is obvious; and it should be insisted on that any *unnecessary* detachment of the divisional artillery from its infantry should be avoided. When, however, it is a question of forming masses of guns in a battle, it is impossible to wait till the infantry come upon the ground. An artillery duel of some hours' duration has to take place before the decisive attack can be made, and the guns must get well ahead, and work for a time independently of their own divisional infantry. The detaching of the guns will be in many cases

Changes of position.—It will generally be impossible to bring the whole of the batteries into their fighting position without some miscalculations as to the space available for them. All errors should, as far as practicable, be corrected while in the *preliminary position.* Where a lateral movement has to be made, when one end of the line has to be strengthened by the transferring of guns from other parts of it, care should be taken to expose the batteries to the enemy's fire as little as possible while in movement. If a battery in action has to be sent to another part of the field, it should limber up and retire to the rear, and then utilise all available cover for its flank march before it again advances straight forward into position.

Effect of massed guns.—A large number of guns having, on the principles above shown, reached their fighting position, it becomes necessary to consider the manner in which they carry out their work.

When a powerful artillery force is in action, one of the first difficulties to be contended with is the smoke.

When the wind is blowing in an opposite direction to the line of fire of the guns, it is most favourable for the attack, as the front of the guns is cleared shortly after discharge, while the aim of the enemy is partially obscured. Similarly, on a moist, windless day, the smoke hangs over the field, and the effect of guns on both sides is much diminished, as the burst of shells cannot be seen, and the flash of a gun is a somewhat indefinite mark to fire at. The actual effect of a dense smoke on a battle-field when large forces are engaged cannot be said to be known from recent experience. Like all obstacles to a clear range, it undoubtedly hampers the defence and aids the attack. Infantry are able to advance in closed formations and deliver their attack much sooner, while the preliminary duel of artillery will be of shorter duration.

On the other hand, an enterprising enemy will be able to concert counter-attacks with greater ease, and exert greater boldness in pushing out his skirmishers to the front.

When wind blows from the flank the attacking guns can, by skilful dispositions, partially neutralise the effect of the smoke by allowing a considerable space between each group of batteries. To exaggerate the intervals between batteries is not advisable, as it renders the fire discipline more difficult; but, as before pointed out, it will be an advantage to keep an interval of about 100 yards between divisions.

The actual position of the massed groups of batteries depends on the ground, and can rarely be much altered from the consideration of smoke, but there seems no reason why the batteries of each division should not be in an échelon formation in such a manner that the smoke of each battery should pass behind that next it. The passage of smoke behind guns has the disadvantage of exposing them very much, as the guns and men stand out prominently on a white background, but this cannot be helped.

When no other means are available, the guns of each group should commence firing in succession rapidly from the leeward flank. A salvo by batteries is in some cases desirable. The influence of smoke on the effect of projectiles is evident. When the object fired at is not clearly defined, it will be difficult to estimate the effect of shells, and judge whether the range is accurate or whether the mark has shifted. For these reasons it is often undesirable to use a shrapnel with time fuse. A percussion shell, of whatever type it may be, whether it be a common shell, a shrapnel acting on contact, or a bullet shell with a double-acting fuse, appears a necessity during some of the phases of a great battle.

Fire discipline in main position.—It has already been pointed out that, when possible, the attacking guns in their main positions are formed in two or three masses. To regulate the fire of these masses effectively is the duty of the brigadier. From him issue the *general instructions* as to the fire of each group; but all details, such as when to fire rapidly each mass of batteries must first be allotted a distinct section of the defensive position. In each section must be pointed out the salient or decisive point, which will have to be overwhelmed with fire when the infantry advance commences.

The commander of each artillery mass further divides the section allotted to it among the artillery divisions which compose it. These carry out their task in the manner laid down in the preceding chapter.

When an artillery division has completed its task by practically silencing the guns opposed to it, its fire can co-operate with the rest of the mass against the remainder of the section of the enemy's line.

When a whole group has fulfilled its mission, the direction of its fire falls, as it were, into the hands of the brigadier, who directs the whole of it to co-operate with one or other of the remaining masses of guns. The fire thus utilised will generally enfilade a portion of the enemy's line at long range.

It may sometimes happen that a mass of attacking guns is suffering very severely from the fire opposed to it, or a change of position has to be effected. In such cases the brigadier may order as a *temporary measure* the concentration of fire of the whole or part of neighbouring groups in order to relieve the pressure experienced. But, as a rule, the guns are occupied with the artillery in front of them until the decisive advance of the infantry takes place. If the fire of the enemy is exceptionally destructive at a particular point, it will often happen that a movement of the batteries there, forward or backward, even as little as fifty yards, under cover of smoke or undulating ground, will completely derange the aim of the enemy. This happened frequently in the Russo-Turkish war.

Preparation for the assault.—While the artillery duel between the guns of the defence and the attacking batteries in their first fighting position is going on, the infantry divisions are advancing and deploying for attack in rear of the guns. The extent to which the power of the defence is subdued will enable the general in chief to determine (1) the the time, and (2) the mode of attack.

It may happen that the guns have so effectively played their part, that but slight further resistance is to be apprehended, in which case a general advance of the whole army corps would be ordered, all the available cavalry and horse artillery being pushed rapidly forward on the flank, in order to enfilade the enemy's line and follow up the pursuit.

When the enemy offers a stubborn resistance, the attack along the front must be undertaken, to a certain extent, in order to hold the troops of the defensive line in their position, but the decisive attack will be made by a division acting on the flank. If possible, the direction of this flank attack will be concealed from the enemy till the last moment, and the infantry should not commence their decisive advance until it is probable that it can be carried out without any check.

As soon as the mode of attack has been decided on, and while the troops are moving up to make it, the brigadier orders the nearest groups to fire on the point to be attacked. The remaining front of the enemy's line must still be fired at by a few batteries. Having detailed one or more divisions to carry out this task, the brigadier transfers his whole attention to that *portion of the main artillery line* which is to concentrate its fire on the point of attack and personally superintends the fire discipline. Having divided the portion of the defensive line to be assailed into sections, which are allotted each to a division of batteries, he details the batteries which are to accompany the attack.

The assault.—For the sake of simplicity it may be assumed that the attacking guns in their first position are formed into three masses, which we may call respectively the advanced guard, the corps, and the divisional artillery group. The horse artillery batteries (one of which belongs to the cavalry brigade) would be formed up with either of the two latter masses. The infantry again may be assumed to attack along evident that when a combined front and flank attack takes place, the duties of the guns employed in each will be distinct.

Frontal attack.—The advanced guard infantry, as has been pointed out, after it drives in the advanced posts of an enemy is checked and remains virtually an escort for the guns in the rear. As the attacking divisions advance they pass the line of guns and press forward by the side of their comrades of the advanced guard. While the flank attack is proceeding the frontal advance must be made with vigour, the fire of the guns becomes masked, and in order to support the infantry they must take up a new position.

The whole of the batteries which have been told off for the attack advance accordingly a stage of from 500 to 800 yards.

Advance of batteries.—The batteries by their fire have to support the infantry near them ; the local points of attack are clearly defined, and the regulation of fire of any large number of batteries by one man becomes extremely difficult. If, in addition to these points, it be considered that the brigadier of artillery and the general-in-chief are in another part of the field, it will be evident that the duty of the artillery will be to aid in a *series of local fights*, and that to carry out the work the best plan is to leave the leaders of *divisions of artillery* independent, in so far as artillery tactics and fire discipline are concerned. Undoubtedly the nearest infantry general in command can call on the guns to aid him, but it should rarely be necessary. The whole tendency of the frontal fight is to make the artillery division leader independent, and for this reason the unit of three batteries should be kept together. In advancing from one position to another it is advisable to proceed by échelon of divisions, those advancing being covered in their movements by the fire of the guns still in action. When the guns of a group are being gradually masked, of course that division whose firing has ceased would be the first to go forward.

The necessity for preserving the individuality of the artillery unit on the battle-field, during the later stages of the fight, in no way interferes with the massing of the guns. Divisions when possible should deploy side by side, and *in the exceptional* circumstances of a frontal attack being *pushed* the whole group can concentrate their fire.

The advance in échelon of the artillery divisions from the first fighting position brings a line of guns into action at some 1,200 yards from the enemy's line.

Advance to second position.—Whether the artillery has to advance to closer quarters, such as 800 yards from the enemy, depends upon the vigour with which the attack is pushed. When the frontal attack is made with a weak force, deployed merely for the purpose of holding the enemy in his lines while the decisive attack is being made on a flank, the guns should not advance until it is clear that the flank attack is succeeding, in which case a general advance of the whole line would be made.

Again, if the frontal attack is made with a strong force, any local success can be aided by the advance of the guns in the vicinity, and the false or containing attack be converted into a real one. When the attack both on front and flanks is made against a comparatively weak enemy, both attacks should be pushed with vigour, but as a rule the frontal attack should follow in point of time the progress of the flank movement.

The flank attack.—The flank attack, as has been stated, would be preluded by the fire of all available guns in the first fighting position being turned on the point of attack, under the personal superintendence of the brigadier of artillery.

The guns thus employed would be on the interior or pivot flank of the attacking division; and it is evident that as the infantry press forward in an oblique direction they cross the front of fire and thus restrict the space available for batteries require the *close* support of guns, it will be apparent that at least a division should accompany the advance. The nearest division of batteries should accordingly be detailed to follow up the attack. As the reserves of the front line of infantry pass the pivot flank of the first artillery position, the three batteries told off limber up and come into action in the centre of the attacking division at a range, roughly speaking, of 1,200 yards from the enemy. The further progress of the attack is the same as in the case of a division acting independently.

While the attack is progressing, the point of attack is vigorously cannonaded by the batteries on the inner flank, which are under command of the brigadier. This group of batteries will advance to an intermediate distance of about 1,200 and a decisive distance of 800 yards from the enemy's line. The advance should be made by échelon of divisions, and the fire of the whole mass directed, as in the first position, to break down the resistance of the enemy at the point attacked. To this group of guns will also fall the task of firing into the reserves the enemy may be bringing up to the threatened point. In this portion of the field, as in the frontal attack, it will be difficult for the brigadier, after the first position is left, to regulate the fire. The divisional leaders already know what is to be done, and should not be interfered with without good cause. Cases from time to time arise when some new mark, such as an enemy's reserves, come into view. In such an event the brigadier can order the fire of one of the divisions to be turned on it. With the masses of guns which are furthering the attack are two or three batteries of horse artillery. It is generally recommended that these, when the advance from the first position takes place, should limber up and rapidly transfer themselves to the *exterior flank* of the attacking division. In this position they will be effective in repulsing a counter-attack and in aiding the divisional guns, while combined with the cavalry they are in the best situation for following up in pursuit. As soon as the enemy's line is carried, the whole of the attacking guns advance rapidly into the position and come into action against the retiring troops; at the same time the cavalry and horse artillery are despatched in pursuit; and strive as far as possible to get on the flanks of the line of retreat. (Pl. XI.)

The following up of an enemy by the field batteries and infantry should be carried out if possible. The latter march too slowly, and are usually too fatigued with their exertions to do much, but the guns can with safety pursue, and at long range, fire on the retiring troops.

CHAPTER XII.

ARTILLERY ON THE DEFENSIVE.

Defence *versus* offence—Different kinds of defensive battles—Commencement of an action—Object of the defence—Requirements of a good position—The main defensive line—Advanced posts—Employment of guns in front of position—Guns in main position—The placing of guns of a division—Exceptions—The case of a small force—The placing of guns of an army corps—Of an army—Duty of artillery commander—Bringing guns into action—Fire discipline—Of a division—Of an army corps—Exceptional cases of the defence—Influence of forms of ground—The decisive counter-attack—Local counter-attacks—The defence of redoubts—Supply of ammunition—Combats de rencontre—The retreat.

Defence versus *offence.*—The old controversy as to the relative value of the attack and the defence has not been, nor probably ever will be, definitely settled. Improvements in firearms have increased the power of the defence, and enable a smaller number of men than formerly were necessary to effectively hold *passively* a certain position. To maintain a passive defence, however, implies inferiority. An enemy can be thus prevented gaining a victory, but it cannot be secured for the defenders. In treating of defensive fights it must be understood that measures must be taken which will admit of a vigorous offensive being at some time entered upon. Where there is no great disparity between the numbers of the contending forces the *defensive-offensive* battle is *theoretically* a perfect battle formation. A slight inferiority in numbers can be compensated for by the ability of the defender to select his own fighting position and strengthen it by artificial means. By a defensive-offensive formation is meant one in which the defenders, while under cover, utilise their fire to the greatest advantage, and when it has produced a telling effect, fall upon the attacking force, which is presumed to be partially enfeebled and disorganised.

In accordance with the traditions of the Peninsular wars, the theory of the defensive has taken deep root in our service. Practice and theory, however, as to its efficacy do not agree, and the superiority of the *offensive*, as exemplified in recent warfare, is so great that it may be assumed that a defender will only take up a position when he hopes that the advantage given by the ground will compensate for inferiority of numbers.

The successful defence of entrenched positions in the Russo-Turkish war, and especially the great range of modern weapons, has of recent years favoured the advocates of the defence. It may be questioned, however, if long range fire has made any material alteration in warfare. Victory can only be gained by troops, whether acting on the offensive or defensive, by the close contact of masses, and the argument that forces can be defeated by *fire* alone, is not supported by the practical experience of war.

The value of long range fire under *special* circumstances is undoubted ; but the ordinary lie of the ground, the necessity for husbanding ammunition, and the bad moral effect on the young soldiers of modern armies, forbid ordinarily its use.

A defending force has to utilise to the utmost the great power given by modern firearms, and endeavour by its aid to obtain a superiority in numbers, either local or otherwise, which will justify an attack. If, in addition, it be remembered that the method and points of attack are not known till the last moment, it will be evident that a *skeleton position*, manned in sufficient strength to hold it, should first be taken and fortify a position, and in it await attack, as the French did at Gravelotte. A force may be retreating, when it is pressed and fired on by a pursuing enemy. A stand has to be made, as, for instance, at Colombey, when the army of the Rhine was attacked by the advanced guard troops of Von der Golz. To this class of engagements belongs the ordinary rear-guard actions of a retiring force which have a distinctive character of their own.

A force may have to make a stand against an enemy very superior in numbers in order to gain time, or carry out some definite object. A purely passive defence can alone be made, and every effort is, in such a case, directed to artificially strengthening the position, and placing obstacles in the path of an enemy. The battles on the Lisaine to cover the investment of Belfort in 1871 afford a good example.

When two armies in advancing come in contact, one of the two will usually have to assume the defensive. Before the conflict of the main bodies, there will be fighting of the covering troops of each force, and in some cases this may take the phase of a cavalry battle with a more or less decisive issue. The result of the advanced guard actions which follow, tends to throw the force that gets the worst of it on the defensive, and the extent to which it deploys up into position to await attack, depends mainly on the facilities afforded by the terrain for so doing.

Where armies are on the move, and their meeting results in an indecisive battle, there will be during the fight a series of phases in which one force or the other temporarily assumes a defensive attitude. The battle of Vionville is instructive in affording instances illustrative of this class of fighting. Again, a force may take up a defensive position as a temporary measure, with the intention of either in it receiving an attack, or threatening the line of advance of the enemy if he ventures to neglect it. The action which Marshal Macmahon fought at Woerth may be adduced as an interesting example.

The principles which govern the action of troops when acting on the defensive can best be studied by taking the case where an army, from one cause or another, deliberately takes up a position, and awaits attack.

The commencement of an action.—The preliminary combat may take any of the forms above alluded to, either of a cavalry battle, an engagement of advanced or rear guards, or the local fighting of small bodies of troops, whether it be special bodies sent forward, or troops composing an outpost line.

It is to the interest of the defender to conceal for as long a time as possible his actual dispositions, and hence all small reconnoitring parties should be driven off. At the same time it will be a mistake to make any serious resistance to an enemy in force out of reach of support from the main body.

Object of the defence.—The method of conducting an attack has before been dealt with. An attacking force endeavours, by pushing forward advanced troops, to cover the deployment of its guns in their first fighting position. The efforts of the defence must be directed first against the advanced guard troops, which should be kept at a distance as long as possible. After a time the advanced guards become strongly reinforced, and then the deployment of the main bulk of the guns has to be checked. Every effort should be made to force the assailing batteries to come into position at long range, and prevent the principal or first fighting position of the attack being taken up except with a heavy loss in men and matériel.

The first task of defending troops is to prevent the deployment of a *superior* artillery force *within effective range.* If attacking troops are permitted to deploy with impunity, the initial superiority they possess will be so firmly established that subsequent efforts of the defence can scarcely hope to be successful. On the other hand, if an advancing enemy carry out its task, one must refer briefly to the position taken up and the manner in which it should be occupied.

A good position.—The requirements of a good position are —(1) Its length and depth should be suitable to the numbers available for holding it; (2) The flanks should be of a nature that they can be effectively defended; (3) There should be a command of view and fire over the country which the enemy has to pass over; (4) It should afford good positions for guns and cover for reserves; (5) The communications throughout should be easy, and ample facilities afforded either to advance or retreat.

The best position is that which contains most of these advantages. The ground in front (except in the case of a passive defence) should be clear of all obstacles, and afford no cover of any kind.

In all ordinary cases it may be assumed that a certain command of view and fire over the front can be obtained, but that some cover in the shape of woods, villages, enclosed land, or undulations of ground exists which favours the attack.

Before considering the manner in which the guns are placed, it is necessary to refer to certain disputed points as to the general disposition of troops.

It will be generally conceded that a defending force will be formed in a main fighting line, a second supporting line, and a general reserve. The first question that arises is, where should the main line be placed?

The main defensive line.—Attempts have recently been made to show that the main position should not be on the crest of a hill, but some 600 yards in rear of it.[1] It is argued that the crest should be held by artillery and skirmishers, by whose fire the enemy would be checked while advancing. When the guns get under fire of the enemy's infantry they are to retire to the position in rear. By adopting this method the main defensive line is but little damaged by the attacking artillery, and the enemy's troops are checked at the crest, and forced to advance under very unfavourable conditions over the last 600 yards. The fire from the position in rear which just clears the crest is considered to produce great effect among the enemy's reserves.

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[1] *Journal des Sciences Militaires*, 1880.

The adoption of this method of procedure has been combated by Brialmont, who points out the disastrous moral effect of men having to wait till an unseen enemy gets within 600 yards of them. The whole of the preliminary combat would fall on the artillery and advanced skirmishers, and their hurried retirement could not but entail confusion.

It may be assumed, then, that the main defensive line will be sufficiently near the crest for the fire of both guns and infantry to sweep the approaches as far as possible, but it does not follow that the infantry should occupy the position during the artillery duel.

A second position some 500 or 600 yards in rear, which should be strongly entrenched, affords cover for troops, who can be used either to support the front line when pressed, or cover its retreat if that cannot be prevented. The general reserve would be in rear.

Advanced posts.—In order to check an enemy's advanced guards and delay their forward movement a certain amount of troops must be pushed in front of the main line. The manner in which an advanced line should be formed is a matter on which there is much difference of opinion. To fight an exhausting action *in front* of the main line of defence, as the French did at Woerth, is obviously a mistake. The fighting is virtually over before the real line of defence is reached, and the *morale* of the defenders is so shaken by their severe losses, that a resolute stand cannot be expected. On the other hand, the advance of the attacking troops must be delayed, and the possession of strong points in vicinity of the defenders denied to them.[1]

front of the main fighting line. In certain cases, however, the advantage gained by an advanced post is so great that this consideration must be neglected.

Employment of guns far in front of main position.—Where there are little or no obstacles in front of a position, and the whole ground is commanded from the crest, it would appear a mistake to push out any advanced posts. At the same time skirmishers should be placed from 300 to 600 yards in front of the main line to check any attempt of hostile skirmishers to get within range of the guns of the position. If attempts are made by an enemy to push forward with cavalry in order to reconnoitre, it will often be advisable to detach a battery of horse artillery with a strong escort to drive them off. The situation of the guns in the main position should not be disclosed till absolutely necessary. Again, in open country a force of cavalry and horse artillery should be ready during the preliminary combat to gallop forward on a flank, and thus take an advanced guard at a disadvantage. When attacking artillery come into action unsupported by infantry, a portion of the skirmishing line should be reinforced, and push rapidly forward against the exposed guns. The artillery of the defence should, however, with the exceptions above noted, not take part in the action, unless the nature of the ground affords opportunities for taking up positions from which the advance of the enemy can be opposed without danger.

Again, if the ground in front of the position is enclosed, if there are woods, farms, or villages *within artillery range* of the main line, two or three of the principal of these should be strengthened as advanced posts, more especially when they happen to be *situated in front of the flanks.* The defenders of these posts should make a stubborn resistance. Their flanks are covered by the fire of the guns in the main position, and ordinarily the retreat would be easy. The troops in an advanced post should not stand the assault of infantry at close quarters, nor should the defenders run the risk of capture. It does not appear, therefore, that, as a rule, guns should go forward to advanced posts, as their retreat would be precarious. These considerations refer solely to advanced posts just beyond the range of infantry fire from the crest of the position—as, for example, the village of St. Marie aux Chênes at Gravelotte.

When a wood, village, or house is within a few hundred yards of the main line, there can be no question of sending guns forward to assist in its defence. The post is, in itself, a part of the position, a salient point in the defensive line which should be held as long as tenable, and which is defended on the flanks by the infantry and artillery fire of the main line.

Guns in main position.—With regard to the main position, it has been pointed out that it is not till the attack of an enemy is clearly pronounced that the bulk of the troops are posted. At the same time the shelter trenches, gun-pits, and artificial cover of all kinds are dug ready for the troops to advance into. The position of the guns is a matter of primary importance. During the preliminary portion of a fight they alone are engaged, and up to its close may be depended on to do good service. Contrary to the procedure of the attack, the dispositions of the infantry should be subordinated to that of the guns.

The ground on which the guns deploy should fulfil, as far as possible, the requirements of a good position as laid down in Chap. VII. The whole front of the position should be swept by fire, all lines of approach enfiladed, and all obstacles commanded. When the flanks of a position are naturally weak, they must be strengthened by artillery. The lie of the ground will rarely permit of guns commanding the whole of the terrain in front of them, and in such a case flanking fire should be sought from distant batteries. Again, in every position there are certain prominent or decisive points which an enemy in his advance is bound to assault. These have to of the defensive in war. A certain portion of the guns must first be posted to cover weak points, especially the flanks, and to some must fall the task of the preliminary combat, but the main force should not be placed till the general features of the plan of attack become known. In fixing on the best situations for batteries it must be remembered that the massing of guns and effective fire discipline is necessary as well as in the attack.

Guns of a division.—Take first the case of a comparatively small force, such as a division, with, say for convenience' sake, four batteries, while acting on the defensive. Under ordinary circumstances a frontal attack of some nature or other will take place, whether combined with a flank one or not. In the event of an adversary entirely neglecting the front the whole dispositions of defence would be changed, and a line formed to meet him as he endeavours to carry out his flanking movement.

If the flanks of a position are not naturally strong, they must first be secured by the detachment of a battery to each. The front defended being small, the fire from these guns should effectively command the approaches in front as well as the ground on the flanks. It is not advisable to open fire till it is absolutely necessary, as, for instance, when advanced posts are being attacked, or an advanced guard is being deployed. The extent to which batteries fire is determined by the division leader. The disadvantage of disclosing the length of the position is usually more than compensated for by the effect of the guns at ranges which are accurately known. In the event of a flanking movement being attempted, the battery on the flank threatened fires at long range in order to keep the enemy at a distance, and thus gains time to make counter dispositions.

The two remaining batteries under the senior artillery officer are kept in rear of the centre of the position till the moment for action. Whatever may be the case when large armies are concerned, there is no doubt that with small forces every available gun of the defence must take part in that artillery duel which is preliminary to the infantry attack.

The time to bring the two batteries into action would seem to be *just before the attacking force deploys its guns in their first position.* From the course of the advanced guard combat, and from the nature of the country, it will be evident where the deployment will be made, and the time at which it will take place can be fairly judged.

The keeping back of the two batteries at first has the advantage of not disclosing to an enemy the real strength of the artillery. It is assumed that these batteries can be concealed; of course, if they are plainly visible there is no object in not at once pushing them forward into their emplacements.

Exceptions.—There are one or two exceptional cases in which it appears best for the guns of the defence to keep their numbers concealed till the enemy's infantry advances. When the defending guns are *very inferior* in number the artillery duel becomes too one-sided an arrangement, and it is best to keep the guns well under cover, and run them out when the infantry advance takes place. Again, when the nature of the country forces an enemy to deploy at very long range there appears little advantage in wasting ammunition on him.

Case of a small force.—Where there is a less force of artillery than a division, the situation of the batteries is mainly dependent on the ground. The whole length of the defensive line taken up is so small that guns in any part of it can defend the whole of the approaches. When, as is often the case, one flank is partially secured or easily defensible, the guns should be massed on the other or exposed flank.

In the generality of cases, however, it is best to take up position somewhere in centre of the line. The guns are better secured from attack, and can be withdrawn with greater manner in which it is occupied. It should be realised that a powerful defence cannot be ensured by trying to make a continuous line equally strong throughout. A few prominent points should be strongly held forming the salients of the defensive system, while the connecting curtains are comparatively denuded of troops.

Whatever be the plan adopted the higher tactical units should be kept together, and for facility of command disposed in a deep formation.

The position of the guns, as far as the ground will permit of it, will be in three groups, which are placed towards the centre and flanks of the line. The groups on the flanks will belong for choice to the divisional artillery, and the third division should join the guns on the weakest flank.

It has been pointed out that emplacements for guns in the skeleton position are chosen and thrown up beforehand, and that also a certain amount of fire must harass the deployment of the attacking advanced guard.

It is not, however, necessary for the whole of the divisional guns to come into action at first. One or two batteries from each group will be sufficient, the remainder keeping well under cover in rear.

It is not a necessity that the guns on a flank should be absolutely at the extremity of the line. They should, however, be sufficiently near it to sweep the approaches over which an enemy must advance to carry out a flank attack.

In the common case of an enemy deploying his advance guards in front of the position, it will be advisable to bring into action two or three batteries in the centre of the line instead of firing from the flanks.

The corps artillery is at first kept in reserve somewhere in rear, and forms up as the central group. As soon as the advanced guard batteries are in process of being reinforced the whole of the guns are deployed and commence the artillery duel. In ordinary cases it would be a mistake to keep any batteries in reserve if the ground admits of their being effectively employed. The attacking force is presumably the superior, and all efforts must be made to check the progress and effect of the guns which are endeavouring to clear the way for the infantry advance.

If the defence possesses a large number of guns the artillery duel must always be accepted. Even if an enemy be numerically very superior he will be unable to put out of action more than a portion of the batteries of so large a defending force, and some guns will always be left to take part against the infantry attack.

Guns of an army.—When a very large number of guns are available the difficulty will be to find room for them. As far as possible the principle of massing in groups must be followed, and no divisional and corps units should be separated. In order to ensure unity in command the corps artilleries should be kept together. For instance, if two army corps are in line, the interior flank of each would be the best position for the united corps batteries. The necessity for keeping a certain number of batteries in hand as *reserve artillery* is a matter on which there is a difference of opinion. It is stated that such a force would come upon the ground too late to take part in the action. It is not argued, however, that a distinct force following the combatant troops should constitute the *army artillery*. In all great battles it is conceded that a general reserve of troops is a necessity, and obviously that reserve will be a corps or division unit to which batteries are normally attached. The whole of these batteries will, mainly from a consideration of space, be unable to take part in the artillery duel, or at all events in the first phase of it. It would seem better to mass the horse artillery batteries into one unit, and leave it to be ordered into the fight at the discretion of the general in chief, instead of maintaining it under the command of the immediate leader of the reserve, whose knowledge of the general course of the action is of necessity less. The rapidity with which is taken up there is always a certain amount of time available for studying the ground. The positions in which the batteries or groups of batteries are to be placed are decided on by the general in command after consultation with the senior artillery officer.

In the case of small forces the artillery colonel makes a detailed study of the ground, accompanied by the majors of batteries. The situation of the infantry advanced posts is pointed out, and the general manner in which the infantry is disposed. Certain distinctly visible and easily recognised places in front of the positions are noted as points which can be referred to in subsequent orders to be given for the purpose of concentrating the fire.

The battery leaders by means of range-finders take the distances of these conspicuous marks, as well as those of any points in their front and flank near which an enemy is likely to advance.

The colonel in command will decide the extent to which artificial cover is to be made, but will leave the details of execution to the majors. If possible the artillery should raise their own emplacements. If fatigue parties of the other arms are used, their work should be planned and supervised by the battery commanders, who are the persons most deeply interested in its being properly carried out.

The points near the position where the batteries can be kept under cover till the commencement of the action should be carefully chosen.

After instructing the battery leaders as to their positions, and the extent to which they are *at the first* to be occupied, the artillery colonel rejoins the general in command, and on some elevated point which commands the view of the front awaits the opening of the action.

The order to open fire should be given by the colonel, who will detail the number of guns, and state which should first engage.

As soon as the order is given to bring all the batteries into action the colonel takes personal command of those held in reserve, and leads them into position.

It is evident that in the case of a small artillery force the command over the scattered batteries is difficult to maintain. Still, by means of *written* memoranda a colonel can without much difficulty control the fire. Theoretically speaking, no ceasing of fire or alteration of position should be permitted without the authority of the general in command; but practically much will be left to the artillery commander, who must attentively follow the varying phases of the fight.

In no case should a retreat be made without order from the chief in command. The guns must hold their own as best they can, even at the risk of capture, till they are distinctly told to limber up.

When large forces are concerned, the brigadier of artillery in a similar manner instructs the colonels of divisions as to their positions and general conduct. He personally takes command of the corps artillery, and leads it into position before the commencement of the artillery duel.

The brigadier receives from the general in command the orders to open fire, to bring all batteries into action, to concentrate fire on certain points, &c., and see that these orders are technically carried out. A great deal of discretion is of necessity left to commanders of groups as to fire discipline, and what to fire at from time to time, but it should be rigidly observed that no movement either forward or back should be made without authority from the chief in command.

Unlimbering the guns.—The actual placing of the guns is usually effected by batteries. When several batteries are brought up, as in the case of the corps artillery, they would advance together in the vicinity of their emplacements, and then each battery be allowed to take up position according to the facilities afforded by the ground. It will generally be best to unlimber some little distance in rear of the position, and push up the guns by hand. Similarly, in limbering up should not be run up into them until fire is about to be opened.

Fire discipline.—The manner in which fire discipline is carried out in a battery has already been laid down (Chap. VIII.).

The power of artillery when acting on the defensive depends entirely on its fire, and to get the greatest effect necessitates unity in command and concentration of fire. As the number of guns increase, so does the difficulty of controlling their fire.

When aiding in the defence of a position, fire can be used with effect at longer distances than in the attack, owing to the ranges being known. For the same reason, and from the greater steadiness ensured by remaining in one position, shrapnel with time fuse can be always effectively employed. To fire, however, at ranges exceeding 3,000 yards produces under ordinary circumstances but little effect, and should not be encouraged.

Take first the case of a division of three or four batteries aiding in the defence of a position. The lieutenant-colonel commanding should regulate the fire generally, leaving details to battery leaders. As the batteries are dispersed he will have to leave the question of rapidity of fire and projectile to be used to his subordinates.

In the preliminary phase of the attack he will inform the batteries on the flank to what extent they are to unmask their position, and how many guns should open fire.

As the enemy's batteries deploy, a *rapid fire* of shrapnel should be ordered from all guns, each battery to fire on the one which is most nearly opposed to it. Time does not admit of regulating fire to a greater extent.

When the whole of the enemy's batteries are in action, and the artillery duel has commenced, is the time to utilise the superior accuracy of fire which the defending guns should possess. The fire of the whole of the defenders should be concentrated by the colonel on the most exposed battery of the enemy. When that battery has been silenced, another should be pointed out to be similarly treated. When firing against guns, shrapnel with time fuses should be used. The majors of batteries should direct their attention not so much to the guns themselves, as to the men serving them, and the waggons and horses in rear. Hence, having got the range, the individual guns of a battery should fire with slightly varying elevation, so as to cover with shell-fragments the whole space taken up by the enemy's guns and limbers.

At the commencement of the action between the contending batteries the attacking force may push forward infantry to drive in advanced posts. It will be the duty of the colonel to direct if any guns are to be turned upon them, and this will depend upon the extent to which the general in command wishes to hold his advanced posts. As a general rule the fire of the defending guns should not be diverted from those of the enemy till a later period. Again, as the attack progresses a portion of the hostile guns advance a stage of some 500 yards, covered by the fire of those in rear.

An opportunity usually occurs to fire on the batteries in movement, but the change will be effected so suddenly that prior instructions to batteries as to what to do must be given. It is recommended that the two centre batteries be ordered to fire on the échelon which is moving, while the batteries on the flanks keep down the fire of the guns still in position.

Each of the central batteries should devote its attention to that half of the échelon which is opposite it. The greatest effect will probably be produced by shell when the échelon is limbering up and unlimbering. The change of position may be expected to take some 4 minutes, and in this time well-served guns should fire three rounds. If the batteries are well in hand the distances can be judged for setting the fuses of the shell without delay. Each successive round should be calculated at from 250 to 300 yards shorter than the previous one, at the discretion of the commander. The of range-finders or sextants. The actual position which the attacking guns will move up to will be generally guessed, and arrangements made for adjusting fuses to that range. It is a great advantage if a salvo from a whole battery can be fired while the enemy is limbering up or unlimbering, but to do so with effect the battery must be thoroughly in hand, and the laying and fuse adjusting to be depended upon.

It has been said that to 'silence the attacking guns is the essential object of artillery on the defensive.'[1] On the infantry, however, the burden of the attack rests. If the defending guns confine their attention solely to the enemy's batteries in the artillery duel there is nothing to prevent his infantry advancing to within effective range of the advanced posts of the position. When to leave off firing at the guns and turn the fire on the infantry is a difficult question to solve. Hohenlohe lays down that artillery should only be fired at when other troops are not within effective range, but admits that the maxim is very difficult to follow.

The following main principles will help the artillery commander in deciding on the orders to be given to his batteries. The attack of infantry is always preceded by an artillery duel, and till this establishes a considerable superiority of the attacking guns, no infantry in force should be able to advance. As soon, therefore, as the infantry supports and reserves try to advance in front of the guns *the whole of the defenders' fire should be turned upon them.* The attack of the infantry will be thus checked, provided the defending guns are not overmatched.

Assuming that the infantry attack makes slow progress, then an advance of the attacking guns will take place. The opportunity of taking the batteries at such a disadvantage must not be neglected; and, as before stated, half the guns will turn on the moving échelon, while the other half will either fire at the standing échelon or on the infantry, *according as to which offers the best target.*

When the whole of the attacking guns have advanced from their first deployment they will be within the range of infantry skirmishers pushed out from the position, to whom would be allotted the task of keeping down their fire. *The whole of the artillery fire should then be devoted to the infantry of the attack.* During the remaining part of the action, when the decisive attack of the infantry is taking place, the fire of the guns must be brought to bear on them. At the same time one at least of the batteries should be directed to watch the enemy's guns, and turn upon them when they again attempt a forward movement.

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[1] *Tactical Retrospect.*

In firing at infantry the formation they are moving in must be studied. While at long range and beyond reach of the effective fire of the defending rifles, a deep formation of skirmishers, supports, and reserves, with considerable intervals between them, is adopted. Hence it would be a mistake to fire only at the skirmishing line, and neglect the supporting troops in rear.

The colonel should direct one battery to devote its attention to the skirmishing line, while the other batteries adjust their shells to ranges of 100, 200, and 300 yards respectively beyond it. By this means the depth of the infantry attack formation will be thoroughly searched by fire.

As the infantry attack progresses, the skirmishing line increases in numbers and becomes more formidable. The fire of the batteries should then be successively diverted on to it, till finally the whole of the guns are firing on the attacking troops, at a similar range. The question of rapidity of fire will have to be left to the battery commanders. In the earlier phases of the fight the fire will be slow and deliberate, except when some fleeting opportunity has to be taken advantage of. In proportion as the infantry make progress the fire becomes more rapid, till at the moment of the assault the guns are served as quickly as possible, and fire can therefore be controlled by its colonel. The artillery brigadier has to direct the fire of the various groups so that they do not interfere with each other.

The *whole* of the artillery attacking guns have to be fired at, and hence the line of their deployment is divided into sectors and allotted to each group. Similarly, when the infantry commence their advance, a portion of their front should be allotted to each mass of guns.

Directions will have to be given to each group as to their action when a change of position of the enemy's guns is attempted, a certain number of batteries being detailed to follow the movement with their fire.

Again, when the plan of the attack is definitely known there will appear on the battle-field certain decisive points which should be overwhelmed with fire. The proper moment in which a concentrated fire of the guns of the defence will be most effective is difficult to know, and to turn all the guns on a vital point at the right time demands organisation of a high order.

Exceptional cases of the defence.—We have thus followed what may be called the normal course of a defensive battle, in which the defender makes a stubborn resistance, but is unable to prevent an infantry attack being delivered, and does not beat off the enemy till the last moment.

Take the case, however, when the attacking guns cannot gain any marked superiority over the defence. If an attack by the other arms is attempted, it may be assumed that it can be checked by fire alone. Hence, when the infantry first advance, the whole of the guns need not be turned upon them, but a portion may be left to continue the artillery duel.

Again, if the defending artillery is thoroughly mastered in the artillery duel, it will have to withdraw and reserve its fire for the decisive assault of the infantry. Whether the guns can again be run up into their former position, or whether it will be advisable to take up a rallying position in rear, is a matter which is difficult to decide.

When the defending guns are once put out of action by an enemy who can continue firing until the assault takes place, it will be impossible to get again forward, and it will be better to deploy on the supporting line of infantry. A battle fought in a position like that taken up at Woerth is an illustration of this.

When, however, an enemy has to push forward his artillery by successive stages, it will always be possible for a portion of the guns to maintain their position, simply retiring under cover till the infantry assault is delivered. The batteries which are most exposed can at discretion be retired to a second position, but should be ready to push forward again into first line if occasion offers.

Influence of forms of ground.—The general disposition of the guns when holding a position is on the crest on both the salients and re-entrants according as the ground lends itself to the forming of groups and affords command of fire.

A position suitable for a large number of troops has, however, but rarely a well-defined crest throughout. A combination of slopes of different degrees of steepness renders it necessary to change position slightly during the course of an action. The summit of a hill, from which an artillery duel can be commenced, is often a spot from which the terrain over which an enemy's infantry has to advance is not commanded. In such a case guns may have to be run forward, which should usually be done by hand. Again, when a slope is very steep, the guns in the main position cannot defend the ground in their immediate front. In some instances an enfilade fire from batteries at a distance can be counted on, but not always. The only case in which it seems advisable to station guns low down on the slope is when ravines run perpendicularly through the position, when a few may be placed at their mouths, so as to give a flanking fire to the foot of the slopes. When this is done the fact of so placing them should course can only be done when the superiority of the attack over the defence is not very marked.

The best time to take the offensive is just when the decisive infantry attack is being delivered, when the supports have closed on the skirmishers, and the assailant is hurrying to the assault. A forward movement of the defensive line, well supported by reserves, checks the attack. The majority of guns on both sides are obliged to stop firing till the issue of the infantry struggle is evident.

In case of success the forward position of the attacking guns will render them liable to capture, and as the infantry advance, the guns of the position follow up the offensive movement as quickly as possible. The tables are turned, and the two sides assume, according to circumstances, the *rôle* of an attacking or defending force.

When an offensive movement of this kind is attempted, it should, if possible, be seconded by a flanking attack from a body of troops hitherto held in reserve. With the reserve should go forward all the horse artillery batteries available. When the flanking attack is made by cavalry, the accompanying guns should move on the *inner flank*. When made by infantry, the batteries should accompany the *outer flank*; and when both arms are engaged, the artillery is best situated in the centre.

Local counter-attacks.—In nearly all battles there will be opportunities for making local counter-attacks, which, however, should not be pushed too far, unless it be deemed possible to make the movement general. When, from weakness shown by the enemy, counter-attacks are made from the *front* of a position, they will only be accompanied by the *fire* of the guns in the main position.

If, however, an enemy makes a flank attack, it can best be met either by a direct movement against the re-entering angle formed between the enemy's main line and his flanking troops, or preferably by attacking by a rapidly moving force the outer flank of the enveloping troops. In the latter case batteries will *always* have to accompany the attack; in the former only occasionally, depending on the success of the movement. Local attacks have, more or less, the character of a *surprise*; and therefore batteries can sometimes push themselves forward rather prominently without much risk. The main difficulty arises when the attacking troops have to fall back, in which case the retreat of the guns is seriously threatened.

The defence of redoubts.—The modern tendency of strongly fortifying defensive positions when time is available, results in field redoubts being raised to defend weak points in the line. To place field guns in embrasures would be a mistake when converging fire can be brought to bear upon them, and when a wide field of view is required. In all ordinary cases the guns should be mounted *en barbette*. If it is decided to place guns in the redoubts, the following rules should be observed. If a superior number of guns are converging their fire on the redoubts, the defending artillery should be withdrawn under cover, and the artillery duel refused. As soon as the attacking infantry advances, the guns are pushed into their places and fire on the supports and reserves. There can be no question of retiring the guns, and they must be fought to the last.

It will be generally preferable to place the guns for the defence of a redoubt in open emplacements in rear of the flanks, so that they can cross their fire over the ground in front. The batteries will then be better protected, and have some power of movement.

Supply of ammunition.—The manner in which reserve ammunition is carried for troops has already been pointed out. The supply of ammunition when acting on the defensive should be easy enough. It would at first appear that the divisional and army corps reserve columns might be closed up to the front, and thus ensure that by no possibility should the ammunition run short. It must be remembered, well-defined point, and that a thorough and easy communication should be kept up between them and the troops in front.

As soon as it is evident that a defensive action is to be fought, the ammunition and store waggons of the second échelon go forward and deposit on the ground close in rear of the battery emplacements the whole or a portion of their boxes.

From them, as far as possible, the rounds should be taken during the artillery duel, thus leaving the battery ammunition and the waggons of the first échelon of the reserve untouched as far as possible.

The ammunition waggons can then retire to the army corps reserve, some 5 or 6 miles in rear, to be refilled or replaced. By this means a supply for the guns cannot possibly run short, and the only inconvenience that can result is the loss of a few ammunition boxes of little value, which can be easily replaced.

The possibility of injury from wet or exposure can be remedied by using tarpaulins and artificial cover. Whatever arrangements there may be, a certain drain is sure to be made on the battery reserve. In the course of every engagement, however, certain lulls will occur, and during these intervals the voids in the limber and ammunition boxes must be filled without delay.

Combats de rencontre.—When two opposing forces meet, there may be at first a doubt as to which side will assume the defensive, but it may be taken for granted that one or the other, after the preliminary combat, is forced to act in this manner. One of the armies may take up a defensive position deliberately on purpose, or it may virtually be forced to do so owing to the rapidity with which its adversary deploys his troops. In the latter case the defending force suffers under considerable drawbacks. In all rencontre fights a great advantage rests with that force which is able first to deploy in fighting order. To cover this deployment is the task of the artillery, and its commander has to decide upon what piece of ground his guns have to form, and then get up his whole force on the spot.

The decision is not so difficult to make as it would at first seem, and the main essential is rapidity in carrying it out. The position of the contending advanced guards is known, and according as the advanced guard leader has instructions to press forward or simply delay, so will the principal artillery position be up to the line of the advanced guard guns or in rear of it. An accurate study of the ground by the artillery leader, first on the map and afterwards personally, will leave little doubt as to the one or two positions afforded by the terrain.

The retreat.—A body of troops is forced, under certain circumstances, to retire, sometimes only for a short distance, as in the case of an unsuccessful counter-attack; sometimes altogether, as when an army is defeated. A retreat may also be purely voluntary, as, for instance, that of an advanced guard falling back to a main position, or that of an army striving to gain a better strategical situation prior to accepting combat.

In all these cases the artillery is able to play an important part. The effect of retirement on the ordinary soldier is more or less demoralising, and artillery is the only arm which is insensible to mental influences.

As long as there are horses to drag the carriages and men to serve the guns, batteries can be counted on to be effective.

Guns should *never* retire from their original position without the express order of the general in command, but should continue in their place to the last, sacrificing themselves if necessary for the good of the other troops. When retiring to cover the retreat of infantry, the guns should not travel at a pace quicker than a walk, and should halt from time to time to come into action, and check the pursuing enemy.

A pursuit by infantry can only last a short time, and cavalry and artillery are the only arms effective in following retreating infantry, this can generally be effected. Again, a pursuing force of cavalry and horse artillery will endeavour to gain the flank of the line of march, and to counteract this movement a similar force should be detached to meet them. From this will result a local combat of the two arms.

The most difficult case of retreat occurs when a force, having commenced a fight, is ordered to retire before the decisive attack takes place. This would be the case in an ordinary rearguard action, or when the superiority in numbers of the attacking troops is very great. The retreat must be made in good order, and the troops gradually be withdrawn to one or more positions in rear. While the main line of infantry and the guns in the centre of the position show a bold front, the flanking guns and the supporting infantry retire.

In taking up position in rear it will generally be best for the guns to be on the outer flanks of the infantry, so as to cross their fire in front of them.

CHAPTER XIII.

THE EMPLOYMENT OF HORSE ARTILLERY WITH CAVALRY.

Necessity of having horse artillery—Efficacy of fire *versus* mobility—General duties of horse artillery—Strategic employment of cavalry—Duties of the cavalry division—Strength of a division—Position of batteries on the march—Escorts—Battery of the advanced guard—Battery of the rearguard—The cavalry battle—Massing of batteries—Position of artillery—The deciding position—Its place—Coming into action—Fire discipline—Conduct in case of success—Defeat—Duties of officer in command—Comments.

Necessity of having horse artillery.—The gradual increase which has of late years taken place in the mobility of field artillery has more than once raised the question as to the necessity of keeping up a force of horse artillery. It is alleged that the experience of 1870 and 1876 has shown that there is but one method of employing artillery on the battlefield, and that no distinction can be drawn between the tactics of a light and heavy gun. Instances are brought forward in which field batteries have closely followed cavalry at speed, and proved their capability of surmounting the greatest obstacles of ground in time of emergency, *e.g.* the ascent of the Rotherberg at the battle of Spicheren. It is also urged that a horse artillery battery affords an unnecessarily large target for the enemy's fire, and that under the ordinary circumstances of a battle the loss in the mounted been unable to keep up; and it is said that even if the mounted detachments under unfavourable conditions suffer heavily, the batteries still preserve a mobility equal to that of a field battery upon which no loss has been inflicted.

The arguments on the subject can be confined, however, within narrow limits. The main conditions which field artillery have to attain on service are—(1) efficacy in fire; (2) quickness in movement. It may be said generally that any increase in the power of fire entails additional weight, which naturally diminishes mobility.

Assuming that both field and horse batteries are similarly equipped, the former have some 4 cwt. additional to carry in the shape of gunners unless the distance is short. As a result, the horse artillery with a similar efficacy of fire have a superiority in mobility which renders them practically independent of the condition of the ground. The carrying of two additional gunners still leaves for a field gun more mobility than is wanted for the ordinary work of the battle-field, and a consequent increase in weight is given to it to procure a greater power of fire.

To retain only one type of weapon and equipment must cause both efficacy of fire and mobility to the *extent that is now possessed* to be sacrificed.

Can it be maintained that efficacy in fire should be in any way diminished? All experience points in the opposite direction. The increase in range and effect of infantry weapons in recent years has been so enormous, that to compensate for it every effort has been made to increase the power of the guns. The contact of masses on the battle-field is now impossible, unless the combat be preceded by an effective artillery fire. The destruction of field entrenchments, which are now a prominent feature in the modern fight, demands a projectile as powerful as it can be made.

Field artillery, then, should have the utmost power compatible with the conditions of *ordinary* mobility, or that which is necessary to bring guns into effective action on the battle-field.

Is such a mobility compatible with keeping pace with cavalry in all its movements, comprising not only rapid manœuvres, but long and sometimes forced marches? The most telling experience on this point has been furnished by some experiments made by the Austrians at Totis in 1874, the result of which proved that field batteries could not keep up with a cavalry division in its movements. The facts of the case were so apparent that horse artillery batteries were for the first time introduced into the Austrian service.

The value of mobility, again, has, if possible, increased. Not only have guns to accompany in long and rapid marches the cavalry divisions covering the front of an army, but a distinct part in which extra mobility is demanded has arisen on the battle-field.

The extent of ground occupied by troops on the defensive, as well as the area covered by troops in the attack, has largely increased. The withdrawal of guns from one portion of the field, and their rapid transference to another, has been proved to be not only possible, but often of vital importance. Again, the wide-ranging movement of a flank attack, or the 'offensive movement of a detached force, . . . which would receive its impulse from the general-in-chief by means of the telegraph,' [1] demands a mobility of the highest order.

To endeavour to combine horse and field artillery in an inseparable whole is to couple the distinctive but necessarily antagonistic features of the infantry and cavalry arm, each of which has a separate mission, requiring the powerful aid of a gun which does not hamper its movements.

Arguments thus far tending to show that horse artillery is in modern times a necessity are not put forward with the idea of reviving the obsolete absurdity 'that a division of cavalry and its artillery form an inseparable whole,' or that 'horse artillery is cavalry provided with cannon.' The days of 'canister tactics' and 'galloper guns' are past, and field

Field and horse artillery form but one arm, with but one object, to be carried out in the generality of cases by combined action. In respect of its superior mobility, however, a distinct *rôle* is left open to the horse artillery, and its duties in the future are, if possible, more active and onerous than in the past.

General duties.—The part played by horse artillery in advanced and rearguard actions, in local combats and on the battle-field itself, differs in no way in point of principle from that of other batteries, and has been already considered in dealing with the action of artillery in an offensive and defensive battle. The proper nature of guns to employ in any duty is naturally the heaviest that can be used to carry it out. When the difficulties of traction render a light equipment necessary, when rapidity of movement is essential, when, in fact, a gain in time will somewhat compensate for loss in power, the horse artillery should be used. The carrying out of wide flanking movements, the extension of long lines of battle, the rapid reinforcement to threatened points, the timely seizure of important tactical positions, the supporting of troops unexpectedly pressed, the carrying out of false attacks, the aiding in a pursuit or the covering a retreat, are all phases of warfare into which time and mobility largely enter, and for which a quick moving arm is eminently suitable.

The *speciality* of horse artillery action, and its use, as contrasted with that of field artillery, is best understood by studying its movements when acting with an independent cavalry division. In such a case the influence of the slower moving services is eliminated, and the distinctive capabilities of the arm brought prominently into notice.

It is necessary briefly to refer to the sphere of action of a cavalry division.

Strategic employment of cavalry.—The next great Continental war will commence with one or more great cavalry engagements, as a natural consequence of the advanced position that cavalry is forced to adopt in order to carry out its work of exploration. The employment of cavalry in force a long distance in front of an army is no new practice. Napoleon constantly detached his mounted troops two or three marches ahead of his main body. The actual system adopted by him has not been handed down to us in detail, nor would it be of much value under the modern very different circumstances of railways, telegraphs, improved road communications, and long-ranging firearms. It is not desirable to go back further than the war of 1870 as an illustration of the advantages an efficient cavalry may gain for its own side, and the disasters that an improper use of the arm may lead to. Aided as the Germans were in that campaign by the comparative weakness of their opponents, they are the first to recognise that what they then accomplished was but a step in advance towards gaining true efficiency. The result of the Franco-German war has given a great stimulus to the study of the organisation and mode of employment of the cavalry arm, especially in its strategical aspect. The rapidity of modern mobilisations, and the consequent advantage in ability to take the initiative quickly, demand that cavalry at the outset of hostilities shall play an important part. In future the concentration of hostile armies will be covered by dense veils of cavalry thrown forward, to which will be allotted the task not only of covering the assemblage of troops on their own sides, but also that of rending the screen in front of the enemy. A cavalry combat under such circumstances seems inevitable, and in order to be equal to such conditions a stronger and more efficiently organised cavalry force than has hitherto existed must be brought on the theatre of war. The basis on which the action of this force—composed of divisions of cavalry—should be founded has been most exhaustively studied, notably by the Germans, French, and Russians, and the results of theory verified as far as possible by practice in peace manœuvres.

2. To cover with an impenetrable veil the movements of the army, and thereby obtain for it security, and enable the plan upon which it is acting to be till the last moment concealed. To carry out these functions the cavalry must keep small mobile parties in contact with the enemy, and at the same time possess considerable fighting and resisting power.

The two duties are distinct, and must be separately provided for. The possibility of having a force formed so as to be equally adapted for either purpose is not now admitted.

The commonly used term of *cavalry screen* is somewhat misleading, and any attempt to employ divisions as a sort of moving outpost force has been proved to be impracticable.

Strength of a division.—It is generally admitted that a cavalry division should consist of about 6 regiments, which appears to be about the greatest number of sabres that can be effectually controlled by a cavalry general on the battlefield. According to our own organisation, a division would therefore consist of 2 brigades, each of 3 regiments, together with 2 batteries of horse artillery.

Recent experiments tend to show that a preferable formation is 3 brigades, each of 2 regiments, with a battery allotted to each brigade. By this arrangement with two brigades in front line one can be held in reserve, and by the increase in the number of guns it is possible at all times to detach a battery when a brigade is acting independently. It appears bad policy to use less than three batteries, as experience has proved—notably at Vionville and Sedan—that when good work has to be effected a smaller number of batteries have to be reinforced.

Position of batteries on the march.—The batteries form, so to speak, the resisting power of the division, and therefore do not march in a position too forward, or in what may be called the exploring zone.

In the war of 1870 each German division covered on an average 20 miles from flank to flank. In striving to be strong everywhere they were weak at all points, and two-thirds of their divisions were virtually beyond the control of their leaders. The success of the German advance was, by their own admission, due to the weak force and ineffective use of the cavalry opposed to them.

It is now generally agreed that a division in the proximity of the enemy should not attempt to cover more than 10 miles of front. The actual disposition on the march depends mainly on the nature of the country, and nearness and character of the enemy, and is especially dependent on the number of good roads available. As a typical formation which should be adhered to as far as possible, it is suggested that two brigades marching side by side, at a distance apart not exceeding three miles, should each detach to its front one advanced guard regiment. From each of these regiments would be sent out the squadrons to form the scouting line, and its immediate supports. Some two to three miles in rear of the centre, on a main road, should march the third reserve brigade, with the three batteries of horse artillery marching behind its leading regiment.

An alternative procedure is to separate the batteries, allot one to each brigade, and allow it to march in rear of the advanced guard or leading regiment. The guns would never be placed near the heads of the advanced guards, as their presence would restrict the action of the scouting squadrons, which could not fall back or manœuvre without exposing the artillery to risk of capture. The second arrangement has the disadvantage of allowing the batteries to get away from the control of the divisional leader, but it is applicable in close country where the resistance is but local, and where in fact a great cavalry fight is not expected.

In the case of very open country when an engagement is imminent, or in the case where only one road is available, the division would consist of an advanced guard and main body. One battery would then follow in rear of the centre of the advanced guard, while the other two would march in rear cavalry commander cannot be expected to seize with decision the fleeting opportunities of a charge, and at the same time keep his attention fixed on the possibly exposed flanks of his batteries. The escort of a line of guns should be at least a squadron, and in exceptionally exposed cases a stronger force.

The battery of the advanced guard.—The mere fact of the scouts and their supports having come in contact with the enemy should not have any influence on the action of the battery of the advanced guard. To unlimber and fire into squadrons which can be driven back by the resources of the scouting line would be a mistake. When, however, the scouting line is definitely checked, either by the presence of troops in force, or by an occupied wood, village, or defile, the battery should at once come into action, while its supporting cavalry advances forward to threaten the flanks of the enemy's position.

The aim of the guns is to dispose rapidly of the resistance offered without checking the advance or calling for the assistance of the main body. It is best for the battery to gallop forward at once to a decisive range, such as 1,500 yards from the enemy, and open fire. A few well-directed shells, combined with a flanking movement of squadrons, will generally cause the precipitate retreat of any small force. As a rule a battery should go straight to the front, as a movement to a flank, under unknown conditions, might lead it into danger, and would certainly occupy more time, and the target presented by cavalry in any formation is sufficiently large.

In the event of an obstinate resistance the advanced guard battery should cease firing and wait for the arrival of more troops, in combination with whom it may again try to force a passage. Every round of ammunition must be husbanded as much as possible, as, owing to the distance from the main army, it is difficult to replace.

In the event of the enemy retreating, a few rounds may be fired without changing position if a very effective target is presented. The battery then limbers up and reassumes its position in column of march, leaving the scouts to follow up and keep the touch with the hostile forces till another check occurs.

As soon as the cavalry in front of an advancing army has driven back the enemy's squadrons as far as the head of their own infantry columns, it has fulfilled its task. Its further mission will then be to keep in contact with that infantry, and resist any attempt of the hostile cavalry to interpose.

Recognising that the cavalry division cannot hold its ground against a combined attack in which infantry plays a part, it will be evident that when the infantry of the enemy is advancing, or supporting an attack of his cavalry, the division is forced to retire.

The ground will have to be disputed at all favourable points, the force acting on the principle of a rearguard. A precipitate retreat for even a short distance would allow the enemy's cavalry to again interpose, and thus enable him to conceal his movements.

The disposition of the division would be similar to that recommended for it in the advance, viz. two brigades abreast, with one on a central road some couple of miles in advance. The flank brigades should, however, be closer together than in the advance. By this arrangement if one brigade is pressed, the other whose pace has not quickened will be left on the flank of the attacking force, and with the aid of its battery may expect to check the forward movement.

The battery of the rearguard.—The object of occupying successive defensible points is to force the enemy's troops to deploy, and thus gain time. The full resisting power of the division has, therefore, at each point to be developed.

The position of the batteries on the march remains unaltered, *i.e.* they would be at the head of the regiments dismount and fight on foot. The advance of infantry can thus be *checked* by fire, but it is notorious that dismounted cavalry cannot withstand the advance of infantry altogether. The first object, then, will be to force a deployment as far off as possible, and to effect this the battery comes into action *close behind the front line of dismounted men.*

As the attack progresses, the next difficulty will be to get the men away before it is too late. Unless exceptionally good cover is at hand, the dismounted men will have to get to their horses when the enemy's infantry has advanced to within some 500 yards. Just prior to their doing so the battery should retire, and take up a position from which its fire can cover the movement.

The position taken up by the guns should always be in close proximity to the line of retreat. In retiring the major must use his discretion as to whether he does so by divisions, half-batteries, or altogether. It has been before laid down that, in order not to influence the *morale* of the troops unfavourably, batteries should retire at a slow pace. In this case, however, the cavalry are accustomed to the rapid movement of horse artillery, and know the object of the retirement. Changes of position should accordingly be effected at the quickest paces possible.

When a vigorous resistance is offered an enemy will generally bring some guns into action, and there is a natural tendency to engage in an artillery duel. The rearguard battery should avoid entering into a contest of the kind, and should if possible retire under cover, and reserve its fire for the cavalry and infantry of the attack.

The cavalry battle.—The contact of hostile divisions on the theatre of war eventually leads to the assemblage of large bodies of troops which engage in a cavalry battle. Similarly on the battle-field, when there is a large force of cavalry on each side, the tendency will be to seek each other out, and engage in a cavalry combat on one of the flanks of the main line of battle (as at Mars-la-Tour). The action of the horse artillery in such a case will now be considered.

A cavalry action differs from an ordinary battle in that action by fire is produced by the guns alone, while the decision is arrived at by the shock action of opposing squadrons at full speed. A battle under such conditions can only last a short time. The tactics must be of the simplest description, and the decision as to what has to be done in the varying phases of the fight must be made without hesitation. After the first shock of the opposing lines a result, one way or the other, is temporarily arrived at; and whether this be turned into a victory, or prevented from causing a disaster, depends to a great extent on the action of the guns.

Massing of batteries.—When preparing for the battle, the batteries must be assembled and put under one command. During the fight the moments when effective fire is of importance are so fugitive that *unity of command over fire* is a vital necessity. To separate the batteries, moreover, would inevitably hamper the cavalry in its movements.

Position of artillery.—The time necessary to form up the division for attack will be ¼ to ½ an hour, varying according to its strength and marching formation. The guns form a movable pivot upon which the cavalry have to manœuvre, and the commander of the artillery should, therefore, be told as soon as possible on which flank he is to keep. The cavalry is usually formed in three lines—a front, supporting, and reserve line composed of a brigade each, at an average distance apart of from 200 to 300 yards. The supporting line is usually in échelon on the outward flank, *i.e.* the one opposite to that to which the artillery has been ordered. While the division is preparing for attack, the guns form up at full interval, either in line with or a little in advance of the pivot flank of the front line as it is being formed.

Whether the guns have to come into action at this stage is entirely dependent on the enemy's artillery. If his guns are in action and interfering with the cavalry deployment, possible to be made as to the moment for attack, and the ground over which it has to take place. The time for the decision being made obviously depends upon the distance and procedure of the enemy's squadrons, and it may be often necessary to advance some little way in fighting order.

The movement of the batteries must not interfere with that of the cavalry, and, therefore, the general line of advance of the guns is pointed out as soon as practicable by the division commander.

In some of the cavalry regulations it is laid down that the guns with their escort should be carried rapidly forward to a position well on the flank, so as not to interfere with the forward movement of the squadrons.

It seems, however, preferable to push the guns at a gallop *straight to the front* and come into action, inclining the greater portion of the cavalry away to a flank. The advantages of this arrangement are that it simplifies the tactics of the artillery; that in ordinary cases the enemy's squadrons, in inclining to meet the attack, expose themselves to enfilade fire; and that more time is allowed for the artillery fire to take effect.

The deciding position.—In the cavalry combat the artillery should rarely require more than *one position*, in contradistinction to the two or three of a combined action. In insisting on this point it is necessary to point out that a cavalry action may be preluded by the contact of small bodies, by advanced and rear-guard actions, and above all by the necessity of protecting the deployment from an enemy's artillery fire. In all these phases, however, the positions are *preliminary*, and depend entirely on local circumstances. It would be obviously impossible to follow out all the variations which result from the movements and position of the enemy. It may happen that the position taken up by the guns covering the deployment cannot be advanced from, owing to the enemy's artillery fire, or the proximity of his squadrons; or the batteries on both sides are simultaneously advancing, and it is doubtful which can come into action first.

The question must be treated in a liberal spirit, and decided that, as a matter of principle, one main position is sufficient; that under favourable circumstances its locality can be defined; and that the horse artillery batteries should get as nearly into it as they can.

Where the position should be.—The theatre of the fight is of necessity very open, but as no fire from infantry is to be apprehended, and as artillery fire will have but little time or opportunity to take effect, the element of *cover* may be neglected. The artillery commander has to look for, first, a good range, and secondly, a position as far advanced as safety will permit.

The distance to which an advance can be made depends mainly on the enemy's squadrons. It would be obviously unsafe to be halfway between the contending lines; while, assuming the squadrons on both sides to be advancing, a position some one-third of the distance could be reckoned on as affording little danger.

The simplest maxim for the artillery commander seems to be—watch carefully the contending forces; estimate, as accurately as judgment will allow, the probable spot on which the two front lines of squadrons will come into contact; and strive, as far as the enemy's artillery will permit, to get into position 300 yards short of, and the same distance on the flank of, the point of first conflict.

To gallop forward some hundreds of yards with a weak escort is apparently but not really dangerous. If the enemy's guns are in action, their fire can be neutralised by moving forward in échelon under cover of the fire of a battery in action. Modern experience, again, has shown that guns have nothing to fear from a *frontal attack* of cavalry. A flank attack in weak force can be met with the aid of supporting squadrons, while the enemy will be too much occupied with the cavalry attack to detach any large bodies. Moreover, as which come into action first, and thereby compel a more distant deployment of the enemy. Rapidity, both in making a decision and carrying it out, is therefore of importance. If it be remembered that the object to fire at during the action will constantly be shifting, and entail consequent changes of front, it will be evident that placing the batteries in échelon will be preferable to forming them in line. By this arrangement each battery can change its front on a central gun without limbering up. That battery which is farthest from the seat of conflict will naturally be the most advanced.

Fire discipline.—As soon as the guns have come into action, the question will arise as to what to fire at. If the advance be properly timed, there will be generally one or two minutes during which attention can be directed to the enemy's artillery before his squadrons are sufficiently advanced to become an effective target. The time will be very short, and therefore the most should be made of it. Before galloping up to the position, the range required should be estimated, the consequent elevation given at once to the guns, and shrapnel shell, with fuse adjusted somewhat short, got ready. Immediately on coming into action, fire should be opened on the personnel of the enemy's batteries. As soon, however, as the enemy's first line of squadrons appear within range, the two batteries on the inner flank commence at once a rapid fire with *common shell*, each battery taking for its object one-half of the enemy's line. The firing is too quick to admit of time fuses being adjusted, and, moreover, the effect of common shell among the horses is even greater than shrapnel. Case may also b used with great effect; and if this projectile could be somewhat improved, it might in the close cavalry combat play a very prominent part. The battery on the outer flank would continue to fire shrapnel on the enemy's guns. As soon as the squadrons of the front lines have met in conflict, the two batteries turn their fire on the supports and reserves The flank battery continues to fire on the enemy's artillery if it is doing any damage at the time; if not, it *limbers up ready to move.*

The other batteries remain in action as long as they have anything to fire at. The only troops they have to fear are the enemy's reserves in the event of the action going unfavourably, and their own reserves are close at hand to help them. Limbering up may be delayed as long as any of the reserve is kept in hand.

A success.—When the mêlée takes place, all is for the moment confusion. Success or failure is denoted by the position of the main cloud of dust; if distinctly on the enemy's side, there is little doubt as to the issue having been favourable.

In the event of the enemy's troops crossing the front of the batteries, they can be fired on from the position. If, however, they retreat in a direction which does not admit of their being fired on, the battery which is limbered up gallops forward as far as the front line of the pursuing troops, and comes into action in a position from which the flying squadrons can be followed with effect.

In the not uncommon case of the front of the guns being masked by a mingled crowd of friend and foe, the artillery commander must use his discretion as to whether he will remain in action, in the hopes of again getting a clear field of fire, or whether he will limber up in order to take up another position clear of the struggle. This seems the only case in the actual fight itself when a change of position is allowable.

A defeat.—In the event of the action turning out unfavourably, the artillery have an embarrassing task. Its commander will find it difficult to realise at once whether the defeat is complete or merely partial. The guns should not retire without orders from the divisional commander, unless it is absolutely necessary to escape capture. While rear, from which they can cover by their fire the retirement of the guns left behind.

In retiring, pursued by a victorious enemy, the main task of resistance falls upon the guns. By rapidly taking up positions on the flanks of the main line of retreat, the progress of the hostile squadrons can be checked. In the event of a village or anything in the nature of a defile having to be passed, the best position to take up is one which efficiently commands the exit.

The C. R. A.—A few words are necessary as to the officer commanding the artillery. His independence is far greater in the cavalry than in the infantry fight. When once he has had his general instructions as to his line of advance and position of his batteries, he is left as it were to himself. The divisional commander will be too much occupied to send him further orders, except in the case of irretrievable disaster. The artillery colonel should thoroughly understand the character of a cavalry action, and be able to feel the varying pulse of the combat. Upon him will depend the unity of fire of the batteries, and by him all changes of objects to be fired at have to be pointed out. The majors of the batteries have quite enough to do to superintend the technical carrying out of his orders. His position would, for choice, be some little distance in advance of the inner flank of the batteries.

Comments.—It will be noticed that a purely cavalry engagement has alone been dealt with. In many instances the cavalry division with its artillery plays a prominent part where other troops are concerned, but in such cases the guns escape from the hand of the cavalry commander, and work in obedience to a higher chief, along with the rest of the artillery engaged. They may of course be kept in hand as a species of reserve, but when employed, their tactics do not differ from that of the rest of the artillery arm. The battle of Mars-la-Tour was initiated by the batteries of the 5th and 6th German cavalry divisions. Their action was, however, very shortly afterwards supplemented by the advent of a quantity of corps and divisional artillery, and the whole of the guns combined took part in the preparatory artillery duel. The subsequent appearance of the infantry on the scene rendered the retirement of the cavalry of the divisions necessary, but the horse artillery guns continued to work with the rest of the artillery.

If it had been expedient to divert the horse artillery batteries from the main battle, and cause them to return to the hand of their division leaders, they would then have been enabled to take a part in the *purely cavalry* battle that took place at Ville-sur-Yron on the same afternoon.

No distinction, again, has been made between an *offensive* and a *defensive* battle, for the reason that every engagement in which horse artillery and cavalry work properly together must be essentially offensive. If, from weakness or other causes, the general plan of a battle is defensive, yet to carry out that plan *offensive* movements must be made if cavalry is employed, though its action may be locally restricted.

In laying down the general principles of the conduct of a cavalry battle, it must be kept in mind that they are founded more on the practice of peace manœuvres than on that of the battle-field. No cavalry action on a large scale has yet been fought out under modern conditions.

To what extent, then, has the increased power of the modern field gun altered horse artillery tactics? The purely theoretical view would be that guns should keep farther away from the mêlée, and in a comparatively safe position, some distance to a flank, utilise their long range.

The most recent Continental writers, however, and especially those who have had practical experience in recent warfare, insist as much as ever on the *close support* of artillery. In the cavalry combat the guns have not only to produce actual physical loss, but also moral effect. With regard to the former, it is somewhat doubtful if a greater effect would to moral effect, there can be no question. Distant fire, in the excitement of the charge, would not be regarded.

It is argued that *close support* now, as in former times, is necessary prior to the shock of the first lines, and that the extensive range of the modern gun can best be utilised by getting as soon as possible into a position from which long-range fire can be used in the earlier stages of the fight, and subsequently close support given at the decisive moment. In comparing the horse artillery tactics of the present with that of the past, the points most worthy of note are—

1. The necessity of greater boldness in advancing. It will often be necessary to gallop forward some 600 or 700 yards in advance of the cavalry line.

2. There should be only *one deciding* position instead of several, and from it the guns should be able to act during the whole course of the fight.

3. Changes of position should take place as little as possible, and guns, when in action, never be removed while their fire is effective.

4. Movements direct to the front are, if practicable, to be preferred to carrying the guns to a flank.

5. In the cavalry fight, in contradistinction to the ordinary battle, the guns must *always* be prepared to hold their own with case and reversed shrapnel at short ranges.

CHAPTER XIV.

ESCORTS.

Necessity for an escort—What guns have to fear—Support to be expected in a battle—Permanent *versus* temporary escorts—Movements to a flank—Movement of isolated batteries—Duty of escort—Position on the march—At the halt—Infantry escorts—Cavalry escorts—Comments.

Necessity for an escort.—Considerable stress has been laid on the actual defensive power of artillery when in a thoroughly good position. A perfect position is, however, rarely met with. If it fulfils all the most advantageous conditions with regard to the ground an enemy has to advance over in making a frontal attack, it will almost invariably be open on the flanks. Any small force, such as a battery, cannot command with its fire *at the same time* more than a limited area of ground, and hence a converging attack made both on the front and flanks by troops in extended order cannot be withstood by fire alone. The aid of troops in support becomes a necessity.

It must be kept in mind, moreover, that guns are brought into action for some specific object connected more or less with the breaking down of an enemy's resisting power, and paving the way for the infantry attack. Diverting the fire of the guns to their own defence whenever attacked would their presence is an escort in itself, but cannot be depended upon for more than a limited time. The guns have to change their position and make their movements independently of the conditions under which the other arms are acting. Artillery, again, derives its power from its fire, and is absolutely helpless while in movement. The whole of a battery, with the exception of the guns, has no fighting value, and must look to other sources for protection.

If such be the conditions under which guns are placed in the ordinary combat, their position when isolated is still more defenceless, and in almost every case a body of troops must be detached for their protection.

What to fear.—What guns in action have most to dread is the approach of infantry skirmishers, either in front or on the flanks, who creep up to the battery, taking every advantage of the cover afforded by the ground.

A cavalry attack is most dangerous when it comes from a flank, but it is often combined with a frontal attack in loose skirmishing formation. Whilst in movement an attack of any sort is to be feared. The guns are liable to suffer from artillery fire, and the mobility of cavalry renders them an enemy even more formidable than the infantry.

Support to be expected in a battle.—In an ordinary action in which the three arms are employed, as long as the guns keep within the area covered by the front of the infantry attack, they can trust to the infantry to protect them in front. Even in the case where positions have to be rapidly changed, and infantry support cannot at once be reckoned on, the guns can be trusted in the interim to guard their own front by fire. Not so the flanks, one or other of which is constantly liable to attack when not actually covered by friendly troops.

Permanent escorts.—One has to consider how security for the guns from a flank attack can be obtained during the ordinary phases of an engagement. To attach a permanent escort of infantry appears a mistake, as it will not be able to follow the guns in their quick movements, and will probably be behindhand at the very moment it is wanted. To attach a body of cavalry would be of little advantage, as the action of this arm is very restricted on the modern battle-field, and it would be itself unable to hold its ground in the presence of aimed infantry fire.

To detach infantry or cavalry as a special escort to guns on the battle-field has the effect of weakening those two arms in order to provide for a contingency that may never arise. The strongest argument, however, against permanent escorts is that the other two arms ought, *as a matter of course*, to act in unison with the artillery and ensure its safety; and if that duty is placed on a special small force, the commander of the troops will feel all responsibility taken off his shoulders, and the guns will not get the support they have hitherto been accustomed to look for from the other arms.

It may be conceded, then, that in the ordinary fight, artillery is frequently exposed to danger, in order to guard against which the artillery commander should look to the *nearest troops* for support. It is his business *to apply for aid in time*, and the leaders of all other bodies of troops should be instructed to give their support when it is asked for.

Movement to a flank.—During a fight, especially if small forces are engaged, an artillery commander will often be desirous of bringing his guns into action some distance away on a flank, from which the enemy's line can be enfiladed or taken in reverse. An escort is wanted to protect the guns in movement and when first coming into action. The artillery commander should call for a squadron of cavalry to accompany him, and at the same time ask that a company of infantry be sent forward as soon as possible with orders to replace the cavalry. The terms squadron and company are used, as they are generally considered sufficient escort for any small body of guns. In the event of the movement of the artillery being a very advantageous one, and being in-

For actual fighting purposes, when the three arms are concerned, an infantry escort is a necessity, and must, therefore, be got to the front as soon as possible. It must be recognised that the duty of the escort is *purely defensive*, and that it is *temporarily* detached for a limited time.

Isolated batteries.—When artillery is ordered to some distance from the main body, it will be either a portion of a mixed force, in which case the previous considerations apply, or it will be itself the main portion of the detachment, the remainder being the escort. There appears to be the same objections as before to allotting a permanent escort, or one for a fixed period. The escort—which would ordinarily be a squadron of cavalry—should carry out the object in view, and when that is accomplished at once return to its own regiment. It is impossible to take infantry in any lengthy or quick movement, but if they can be called to the aid of the batteries before the moment of attack, so much the better. When an enemy is exceptionally strong in cavalry, escorts will have to be very strong. In the case of the horse artillery batteries acting with the cavalry in front of an army a regiment is in some cases required.

Duty of escort.—The officer in charge of the escort should, if possible, be junior in rank to the artillery commander, and, in the event of his being senior, should be made to understand that he must not interfere with the action or movements of the battery. The artillery officer is responsible for the carrying out of the work to be done by the guns, and his wishes must be deferred to.

As hitherto explained, the main duty of the escort is to defend the guns from attack, but it must not be forgotten that it also has to guard against surprise. The approach to close quarters of hostile troops may absolutely wreck the personnel of a battery in spite of the escort, while if due warning be given, the guns will have time to aid in their own defence, can retire temporarily under cover, or, if badly pressed, take measures for retreating.

Position of escort on the march.—The escort on the march may be assumed to be formed of cavalry, who either in the advance or retreat would act as an advance or rear guard with flankers moving on the most exposed side. It will be often advantageous to divide the escort in two, to guard both head and rear of column. In covering a flank movement the position of the squadron would be some 300 yards from the guns on the side exposed to the enemy's attack. In very close country the escort is confined to the roads, and in such a case an adjacent road, if anywhere near, should be guarded by patrols. A battery should avoid coming into action until the position to be taken up has been reconnoitred and the cover in the vicinity searched.

Position of escort at the halt.—With a battery in action the best escort is infantry; but this arm, being slow in movement, will often not be with the guns when they first unlimber. Cavalry have first to develop their utmost resisting power until supported by infantry. When there is a mixed escort of both arms, naturally the quickest-moving one will push out to the front for exploring purposes.

Infantry escort.—When there is an infantry escort, it should be worked on similar principles to an outpost line. Nothing should be able to come within a mile of the battery without being seen, and the enemy's skirmishers should be kept at least 1,000 yards off.

The escort would generally be divided into two parts: (1) a line of skirmishers well in front of the guns, who both keep off by their fire the enemy's skirmishers, and act as sentries on the look-out to give the alarm; (2) a main body situated in line with and some 150 yards to the exposed flank of the battery, whose main function would be to resist to the last moment.

The actual position and numbers of the front line depend mainly on the lie of the ground. Any cover within effective infantry range of the battery should be [redacted] the enemy. The fire of front a strong skirmishing line affords great protection. If the ground is very open, a weak line of sentries to give warning is sufficient. In the event of an enemy pushing forward with determination the front line must not hold its ground too long, but retire to the main body so as to clear the whole front, and enable the guns to aid in their own defence. If the position of the battery is sufficiently lofty to permit of the skirmishers retiring directly upon it and lying down in front of the guns, it will be an advantage. The main body will of course utilise cover in its vicinity, and should send out moving patrols or vedettes well to the outer flanks.

Cavalry escort.—The position of a cavalry escort will mainly depend on the troops with which it has to contend. In the event of a cavalry attack being apprehended they would be drawn up some 200 yards in rear of and clear of the exposed flank. Cavalry scouts should be well out to the front of the flanks, so as to give timely warning; and the main body should be prepared to charge the enemy before he can get within 300 yards of the guns. When an infantry attack has to be met, it will be advisable to dismount a portion of the squadron, and send it to act as infantry skirmishers in front or flank as the case may be.

The main body of escorts should always be placed so as to avoid loss from badly aimed shell directed against the battery, and should be at least 100 yards away from any of the waggons.

Comments.—A thoroughly efficient escort should possess to a high extent both mobility and defensive power. It is obvious that *both* these qualities are not possessed either by cavalry or infantry. A hybrid force, such as mounted infantry, has been suggested for this service, and without doubt it would be most valuable, and increase the offensive power of artillery to a great extent. In fairly open country, with the protection of such an arm there scarcely seems any limit to what a powerful brigade of guns might effect.

The question of the employment of a force of this type is pertinent to that of a *permanent* escort, which has been already referred to. It would be a mistake to create a new force for escort duty, as it would result in making cumbrous the command and administration of the present handy artillery unit. If, however, mounted infantry be an arm distinct in itself, one of whose recognised functions is the supporting of artillery, then its value is indubitable. Such a force could be organised at the commencement of a war. Suggestions have also been made as to mitrailleuses being attached to batteries, weapons the general value of which will be subsequently considered. The service Gatling is not adapted for the purposes of an artillery escort, as they are so easily put out of action. When a battery takes up a position it is nearly always under artillery fire, and the moment the presence of a mitrailleuse is known the enemy's fire will be directed on it, and without doubt render it at once useless.

The plan of carrying an escort on some species of carts has been more than once attempted. The expense of having any permanent arrangement of this kind would be great, and add considerably to the matériel of batteries. If not permanent, it would only act as long as the batteries follow practicable roads.

Scarcely enough attention has been paid to the mounting of infantry on the waggons, as was done by the horse artillery of the cavalry divisions in the Orleans campaign. Horse artillery can with ease take an escort, but even with field batteries half a company could at a pinch be carried. By using the axle-tree boxes and crowding a little, 14 men can be carried by each subdivision. Allowing for 6 gunners, 50 infantry could be conveyed for a short distance.

By an arrangement of saddles on the off horses the number could be considerably increased.

CHAPTER XV.

LOCAL COMBATS AND THE FIGHTING OF THE FUTURE.

Defence of a village—Attack of a village—Defence of a wood—Attack of a wood—Attack and defence of defiles—Necessity for range-finders—Method of using them—Range-finding systems—Sighting of guns—Advantages and disadvantages of mitrailleuses—The modern type of weapon—Its tactical employment—Increasing power of artillery—Necessity for cover—Artificial cover—Steel shields—Supply of ammunition.

To lay down definite rules for the action of artillery in all the minor operations of war is an impossibility. Guns will always have to engage guns in the first phases of a combat. As soon as the artillery duel has continued a sufficient time to establish distinct superiority on one side, the artillery of the side which has obtained the mastery utilises its success by aiding the other arms in a manner befitting the particular circumstances of the case.

Defence of a village.—In defending a village the best position for the artillery is on or in rear of the flanks, the guns being placed so as to sweep the whole of the approaches. The enemy's artillery will be first engaged, but as soon as his infantry begins to attack at least half the guns should be turned upon them. In the event of an enemy possessing a great superiority in number of guns, those of the defence should be kept under cover until the infantry advance commences.

The main object of the defence is to preserve intact as long as possible the lisière, or entrenchments in front of a village. By pushing forward batteries well in advance, an early deployment of the enemy is forced, and the guns when pressed can retire into their entrenchments on the flank. A notable instance of the success of this manœuvre occurred at the battle of Noisseville, where the Prussian guns pushed forward some 800 yards beyond the first line of defence, and after checking the attack for about two hours retired on the flanks of the village.[1]

When a village is situated in a hollow with high ground behind, it is sometimes advantageous to place guns in rear of it which can in the first instance fire over it, and afterwards if it be captured prevent an issue from it. At Ligny, the French, after capturing the village of St. Amand, were completely stopped from coming out of it by the action of guns posted in the rear. As a rule guns should never be placed within the defensive line. If it be deemed advisable to have a few guns in the outer line of defence in order to sweep some narrow approach, they should be treated as guns of position, be placed in entrenchments, and their presence concealed until the infantry attack is distinctly pronounced.

When an enemy has succeeded in taking the first line of defence the guns should if possible retire to a position from which they can command the issues out of the village. While fighting is going on in the streets fire at long range should be directed on the enemy's reserves, and an endeavour made to check the advance of his guns, which will inevitably follow up the attack.

Attack of a village.—The attack of a village properly prepared for defence and resolutely defended is a most difficult undertaking, and if possible a turning movement should be made, so as to compel an enemy to evacuate it through fear of being cut off. When this is not possible the attack should be essentially of an enveloping character, being delivered simultaneously in front and on both flanks after a vigorous preparation by artillery fire.

The attacking guns will be able to come into position

The whole of the guns should then concentrate their fire on the village, the first line of defence should be searched by an accurate shrapnel fire while the attacking infantry are advancing; and when the front of the guns is covered, percussion shells should be fired over the heads of the infantry against the houses forming the second line of defence.

The accuracy and effect of modern shell fire render it probable that the use of a powerful group of batteries covering the infantry attack up to the last moment, will have so great a moral effect on a defending force who are naturally crowded together, that the first line of defence will, under such circumstances, be captured with comparative ease.

Stubborn fighting in the interior of a village can seldom be aided by guns, and the attacking batteries will have to move forward on the flanks, and fire into the rear of the village and the enemy's reserves.

There appears but little doubt that, under favourable conditions of ground and atmosphere, the action of a large number of batteries materially lessens the danger of an attack on villages, and hence every available gun should from the first be turned on them. With a weak artillery force, the serious difficulty of dislodging an enemy from efficient cover still remains. Where the conditions of both the power of the guns and the nature of the terrain are in favour of the attack, it may often happen that the defenders will be turned out by artillery fire alone.

Defence of a wood.—In defending a small wood or series of coverts, the guns should be placed in rear of the flanks, and disposed so as to sweep the approaches. In the case of a large wood some guns will of necessity be in position in the lisière, and should for choice be placed in the re-entering angles.

Where roads, or lines of approach, pass through the wood the guns should be close to but not on the actual point of entry. It is advisable that the ordinary interval between guns should be increased and that each should have more than one emplacement into which it can be run up.

The object of the guns when acting defensively is to prevent the attacking force from gaining possession of the *edge of the wood*. When that is lost, the guns on the flanks, or any that may be able to get away in safety from their place in the lisière should strive at once to assemble on some position in rear from which they can command the exit on the other side.

Attack of a wood.—The attack of a wood is more difficult than that of a village. The defenders are less exposed and much safer than when in houses. It is not easy to discover how the wood is held, where the guns are placed, and which are the weak points, nor is it often possible to ascertain even approximately the number of the defenders.

When a turning movement is not practicable, the whole object of the attacking guns is to enable the infantry to pass over the open ground swept by the fire from the edge of the wood, and then get a firm lodgment in it. A preliminary combat of artillery is only necessary to subdue the guns of the defence. It is of little value to shell the edge of a wood unless, in so doing, the advance of the infantry of the attack is being forwarded. In order to find out as soon as possible the strength of the defending force, it is advisable, instead of one, to make two or three distinct simultaneous attacks. The communication between the reserves, supports, and front line in a wood is necessarily difficult, and it will seldom happen that the various points attacked are all equally reinforced.

The artillery in groups should from the first be able to push up to within 1,400 or 1,500 yards of the edge, and support the several attacks. Towards that point at which an enemy shows the greatest weakness the whole of fire should ultimately be converged, and a lodgment effected by the infantry force which has experienced the least resistance. The attention of the guns should then be directed to the other attacks, and they should not leave their last taken-up the attack and defence of defiles is so intimately bound up with that of the other arms, and so dependent on the particular circumstances of the case, that a few general maxims can alone be laid down.

In the case of a short defile, such as a bridge or ford on a river, the position taken up by the guns of the defence depends mainly on whether the troops are going to advance, or are in process of retiring. If an advance is to be made, the artillery is pushed forward with the leading troops, and takes up a position well to the front, so as to keep the enemy at a distance while the passage is being effected.

If, on the contrary, the defile is being held by a rearguard, the guns are kept on the hither side, with the river between them and the enemy. The artillery should, if possible, sweep with its fire all the approaches to the bridge, and a few guns, well protected by cover, be placed so as to enfilade the actual points of passage.

To withdraw the guns to a position somewhat in rear, so that they can concentrate their fire on the defile itself, is sometimes necessary, especially when there is good cover on the enemy's bank of the river. It must be remembered that all defiles can be turned, and that the defence is simply a matter of gaining time. Hence, as a rule, keep an enemy at a distance, so that the actual difficulties to be surmounted may be unknown to him as long as possible, and his arrangements for turning the obstacle be in consequence delayed.

The attack of a short defile is a difficult operation. As a rule the guns will cannonade the troops in the immediate vicinity of the passage, while a turning movement of cavalry and infantry takes place unseen by the defenders. If a frontal attack is inevitable the artillery should act with boldness in following up the attacking infantry. The guns of the defence must first be silenced, and a concentrated fire kept on the actual defile itself, so as to prevent as far as possible any attempt to blow up or otherwise destroy it.

The main difference in the combat in long and short defiles consists in the fact that in the former case the defender can instal himself in the interior, and the attacking force can only take measures against one portion of the defile at a time. The part which can be played by guns in long defiles such as mountain passes and enclosed roads is slight. In mountain warfare field guns are confined to the roads and tracks, their movement is necessarily slow, and they take too much room on the line of march. Hence, as a rule, but a few mobile guns accompany the head of a column in its advance, through a defile. The condition of the roads mainly determines whether a certain proportion of guns is interspersed among the infantry, or whether the main bulk of them follows up in rear.

On the other hand, field guns can be used with effect in defending portions of a long and narrow way, but their duties are essentially those of guns of position, and it is practically impossible to move them in the event of a reverse.

In the most recent form of mountain gun the barrel is composed of two parts, which are screwed together before firing, thus gaining a more powerful weapon while still retaining the advantage of pack transport. A gun of this type was tried in Afghanistan, but the circumstances of the campaign were hardly such as to decide questions relating to regular warfare.

In mountain warfare the fighting as a rule takes place on the slopes or heights on the side of the actual defile itself. In the attack there is constantly the effort to outflank, and thus turn the defending line, while the defenders must necessarily extend to counteract the movement. The infantry, who have usually to traverse ground of a steep and broken type, can nearly always be accompanied by light mountain guns conveyed on the backs of mules. The proper tactical employment of these weapons depends entirely on local considerations, the nature of the country, and the force and fighting value of the enemy. As a rule they are out-with its formidable shrapnel, some accurate system of range-finding must be adopted. The rough and ready method of trial shots is good as far as it goes, but it has the drawbacks of expending without destructive effect a certain number of shell, of occupying some time after the guns are in action, of prematurely exposing the position of batteries, and of being only moderately accurate at long ranges. Artillerymen will always have to be practised in picking up the range by firing trial rounds, but there seems no reason why a more accurate system of judging distances should not be superadded.

When the distance of an object is known, to lay a gun so as to hit it is, under modern conditions, a mere mechanical operation, and the firing of a shell so as to burst in the immediate vicinity of the point aimed at, a certainty. The difficulty of estimating distances over a strange country at long ranges, and under varying conditions of atmosphere, by means of the unaided eye is so great, that the results are practically unreliable. Moreover, the correcting of the opinion of an observer without undue delay by means of trial shots requires constant practice, and the expenditure in peace time of a far larger number of rounds of ammunition than Government will allow.

By an efficient system of range-finding far greater destructive effect from a gun may be hoped for, the confidence of gunners in their weapon will be increased, waste of ammunition checked, and a consequent saving in transport gained.

Experiments have been made in nearly all countries with a view of finding out the best practical range-finder for field service. The various systems adopted give results more or less accurate, but all of them far surpass any trial shot method under the ordinary conditions of the range. Curiously enough, the only occasions on which range-finders have been employed on service do not show them in a satisfactory light. An instrument, in order to give accurate results, must necessarily be complicated in its nature, and require the most careful and accurate handling. It appears, therefore, a necessity that those who work with it should have a long and careful training, and this necessitates an extra number of men and a consequent expense that the military powers are somewhat loath to incur. The extra power given by accurately judging distances is not yet sufficiently appreciated, and it can be a matter of little wonder that the perfunctory and ignorant discharge of important range-finding duties by men who have other work to do leads on service to results the reverse of satisfactory.

Viewing the matter purely in an artillery light, it appears that it is worth while expending a few minutes in finding the range for long distances, say a mile and upwards. If shorter distances are taken it may also be of service, provided that there is *no delay in opening fire*. By using the methods before described, distances under a mile can usually be judged by trial shots with quite sufficient accuracy for service, and at the same time the notable advantage of getting the guns more quickly in action is gained.

Method of using.—It would appear clear that range-finders under all conditions should be used *before* batteries come upon the ground. The carrying of an instrument with batteries, and the detailing certain men for its use, is theoretically simple enough, but it breaks down in practice. The reconnoitring of a position should be done by the artillery officer in supreme command, and it is only by attaching to him a range-finding staff that the various distances on the terrain can be calculated in sufficient time to avoid delaying the advance of the guns. The personnel of a battery, it must be also remembered, has quite enough to do with its ordinary work, and there is a natural dislike to allowing a certain number of men to escape their routine duties in order to advance and find ranges which may possibly be never used. If a range-finding system be properly employed there seems, moreover, a still more extended field the staff officer and engineer can with greater facility draw up sketches and reconnoitre positions; and that both the artillery and infantry arms can utilise for their own benefit the previously acquired knowledge of distances. If range-finding be entrusted to a certain number of picked mounted men, who in time of peace are kept together and are constantly in training over all sorts and conditions of ground, it may fairly be prophesied that none of the fiascos of the past will occur in the future, and that a great extra efficiency will be gained by those troops who are enabled to utilise to the utmost the accuracy of the modern rifle and gun.

There appears no valid reason beyond that of expense why a troop of range-finders should not be in constant training at a place like Aldershot. Led by efficient officers, and constantly exercised with other troops in mimic warfare, they would rapidly pick up a certain amount of tactical knowledge, would know what classes of distances to take and when to take them, and thus become, when allotted by twos and threes to the various staff units of an army in the field, an adjunct the value of which it is difficult to overestimate.

Range-finding systems.—In order to be efficient, a range-finding instrument should be accurate, easily and rapidly worked, durable, portable, and not difficult to repair. One observer only should be required, and no calculation should be necessary. The following are the chief systems which have been tried.

1. The *optical*, or the judging of distance by observing through a telescope the size of a distant object—it being evident that the further an object is, the smaller will be its size. To this class belongs the Elliot macrometer. The main objections to it are that the actual dimensions of an object are seldom known, and that, in many cases, it may be impossible to take the range at all.

2. The *acoustic*. The time is observed between the flash of a gun and the moment at which the report reaches the ear, or the moment of firing a gun and the time when the shell strikes the ground or explodes. The velocity of

sound or shell being known, the distance is mechanically calculated. The drawbacks are that there is always a considerable personal error, and that no range can be found till the firing commences. Of this class the Le Boulengé telemeter is a type.

3. The *trigonometrical*. A base either long or short is either directly or indirectly measured. From each end of it both angles to the object are observed; or, the base being adjusted so as to form a right angle at one end with the line of direction to the object, one angle only is taken. The necessary calculation of the unknown side of the triangle is made mechanically.

In instruments of this type, either a telescope, sextant, mirror, or prism with fixed angles, or a combination of them, is used.

The Watkin range-finder has now been definitely adopted in our service, as complying most fully with the requirements of judging distances in the field.

The instrument is double-reflecting, on the principle of the ordinary sextant, but arranged so that the *near* object is seen by reflection and the distant by direct vision.

An auxiliary base of 6 yards is measured by pickets on the ground, and a right angle to the object and a longer base are laid off and calculated from it. An observer at one end of the base thus obtained causes the reflection of the picket at the other end of the base (which forms the right angle) to coincide with the object aimed at, by means of a screw movement, which at the same time shows mechanically on the instrument the range in yards.

The sighting of guns.—Closely allied to the question of range-finders is that of sights. It is evident that in order to obtain the full value of the modern gun of precision, the means of laying it with great accuracy must be possessed.

ported on when tried at the range, are found to be liable to damage in transport, and require more skill and steadiness in handling than can be expected from the average No. 1 in the heat of an action.

When once, however, range-finders are placed on a satisfactory footing, there is little doubt that telescopic sights will be definitely adopted.

It would appear that for all ordinary work the new pattern sight is sufficiently accurate, but when very great accuracy or a long range fire is to be desired, the power of the telescope would be advantageous.

It appears advisable that a few telescopic sights should be carried with a battery, and that all the guns should be fitted with the necessary brackets, so that they can be used when opportunity offers.[1] It would be a great advantage to arrange that the telescope which the officers of a battery carry should be that which can be used in laying the gun.

Advantages and disadvantages of mitrailleuses.—For some years after the Franco-German war the efficiency of mitrailleuses in the field was constantly discussed.[2] It was generally admitted that under certain conditions their value was very great. Many instances are on record of their enormous destructive power when defending anything in the nature of a defile, when the range was clear, and there was good protection from artillery fire. The Montigny mitrailleur used by the French in 1870 was almost as heavy, and required as many men and horses as a field gun. Adopted originally by them as a makeshift when their infantry was in process of obtaining a breech-loader, it was hastily arranged in batteries and worked as artillery by men who, it is admitted, made a bad tactical use of it. It cannot be denied that in defending villages, field entrenchments, bridges, &c., under circumstances when it is covered from artillery fire, the power of a machine gun is obvious and undoubted. Despite their defective employment in 1870, the majority of French officers continued to believe in their value. The opinion of the staff of the 6th corps d'armée, which held the right of the French line on August 18, that the St. Privat position could not have been taken had mitrailleuses been placed behind the village walls, has frequently been quoted.

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[1] A commission of French officers sitting at Rennes in 1880 reported very favourably of a sight invented by Major Scott, R.E., and recommended its adoption in the service.

[2] *Report of Colonel Wray's Committee. The Gatling Gun; its Place in Tactics*, by Captain Rogers. *The Employment of Mitrailleuses*, by Colonel Fielding. *Bulletin de la Réunion des Officiers*, October 1874 &c.

On the other hand, it is stated that a mitrailleuse is in its general attributes a field gun, requires horses for draught, men to man it, and waggons to carry ammunition. Even if it has the advantage over artillery at short distances, it does not possess either the range or destructive effect of a gun. As the number of carriages which accompany an army is from various causes limited, it is inadvisable to substitute for guns weapons the value of which is not always apparent. If there is a possibility of adding to the number of carriages which accompany an army, extra guns will give more power than machine guns at a less expense. It seems admitted that mitrailleuses are chiefly useful in acting defensively, and are easily put out of action by artillery fire if attempting to accompany troops in the attack. Objection is consequently raised to the tactical employment of a weapon of this kind, as it is unsuitable to attach to artillery, will prove an encumbrance to infantry, and will only be of advantage to cavalry under exceptional circumstances.

Without dealing further with the arguments heretofore held on either side let us consider how the matter now stands, and what will be the probable phase of development of the more recent types of weapons.

The modern type of weapon.—The idea should be dismissed that machine guns have any similarity in employment ing, and 1,000 rounds of ammunition altogether weigh some 200 lbs., it is obvious that a carriage can be made for the conveyance of one or more of any reasonable lightness and consequent mobility. It is generally recognised that a light pattern of weapon will alone be used in the field, and it seems a mistake to make the means of its conveyance anything like a gun carriage in shape. As there is no recoil, a tripod stand and a certain number of rounds have to be conveyed to a given spot by some species of light cart or waggon if pack transport is not used. A mitrailleuse of the type suggested can be carried with ease by two men, can be concealed in a shelter trench as effectually as an infantry soldier, and can from the ordinary loophole of a wall or stockade pour forth the united fire of 50 marksmen.

The construction is so strong that the ordinary bullet or shrapnel will rarely be able to injure it, while the firing arrangement is so simple that it is almost impossible to get out of order. With a weapon which requires no special equipment, can be carried on a horse, thrown on the top of any waggon or cart, and at a pinch carried by hand, there can be no reasonable objection raised as to the impedimenta its conveyance entails.

The objection to the difficulty of removal under adverse circumstances cannot of course hold good in the case of a weapon so extremely light, the essential part of which weighs but a few pounds, and can be taken away at any moment.

The disadvantages of mitrailleuses of the Montigny or Gatling type do not exist in the most modern specimens of machine guns, and it now remains a question as to whether a new scope for tactical efficiency has not been thrown open for a hitherto untried weapon, of which the practical value can be tested at a comparatively trifling expense.

It is difficult to estimate the number of men who can produce with their rifles the same effect as a mitrailleuse. Under the conditions most favourable to its use, such as sweeping a narrow defile, the machine gun is obviously better than the small number of soldiers who can replace it. On the other hand, in open ground, if the aim of a mitrailleuse has to be constantly shifted, its value and rate of firing decreases. Whether a machine gun be deemed equal in its effects to 10 men or 50 is a matter of slight importance, but the point now to be decided is whether the disadvantage of carrying a weight of 200 lbs. is sufficient to counterbalance the advantage of having a repeating rifle which fires 200 rounds a minute, which is cheap, strong, and simple in construction, not liable to get out of order, and extremely mobile.

Its tactical employment.—It may be fairly assumed that in those situations in which the Gatling is effective, such as when commanding defiles, behind walls, protecting villages, &c., the new mitrailleuse will be of equal value. In addition it must be remembered that the modern weapon can without difficulty be transported and brought into action in any place where an infantry soldier can use his rifle. There appears, however, a still more extended field for its use.

Assume that two or more of these repeating rifles be attached to each battalion of infantry. There seems scarcely a case, when troops are acting on the defensive, in which the machine gun would be out of place. When lines of shelter trenches are occupied they would be placed on the flanks, or on those spots from which their fire would be most effective. Concealed with ease during the preliminary artillery duel, they could be brought at once into action as soon as the enemy's infantry attack commences. As the distance to the various conspicuous points of the terrain over which an enemy has to advance is known, it is evidently possible at any moment to cover with a torrent of *accurately aimed* bullets the spots where a battery is coming into action, a reserve is in close formation, or a body of troops is from any reason in close order. Various theories as to the employment of volley firing and long range fire of infantry are now being persistently pushed forward. If the obvious advantages of showering a distant hail so as to cover a great or small area of ground at the will of a single operator, gives an agent for long range firing more powerful than could hitherto have been hoped for.

Scope for the use of a machine gun does not seem to be limited entirely to the defence. It does not seem possible that they should accompany attacking skirmishers, but with the reserves and occasionally the supports, there seems no reason why the horse carrying the gun should not follow as well as those of the mounted officers. Where cover is afforded by undulations of ground at any distance within 1,200 yards of the point attacked, it seems possible to use the gun in firing at long range, especially against the enemy's artillery. It may be sometimes better for a few men to carry the gun and its ammunition when the fire is severe ; and a gun once placed, even if not shifted in position, will undoubtedly help the attack, and be of inestimable service in aiding the reserves to cover a retreat.

When working with cavalry a system of pack transport would always be used. The gun with a small detachment could accompany cavalry in all its ordinary movements over every class of country. In aiding mounted men in their reconnoitring duties, and when resistance is encountered in occupying defensively important defiles, bridges, or cross-roads, or in fact in all those cases when mounted troops are thrown on the defensive and required to dismount, the presence of a weapon of the type foreshadowed is of undoubted advantage.

The disadvantage of permanently attaching machine guns to artillery is obvious. There will always be the tendency to use the weapon as a *gun*, whereas its true value consists in its being a *rifle*. To comprise in one unit agents of so essentially different a range and method of employment is to repeat the old error of combining guns and howitzers together. In the one case of forming an escort for the guns lies apparently its true use. The cavalry escort of a rapidly advanced battery would be materially strengthened by the presence of a powerful repeating small arm, and with the aid of two or three of these weapons be enabled to secure the flanks of the guns from attack, till infantry are able to replace them.

Valid objections may undoubtedly be raised against any attempt to introduce a *fourth* arm into the service, but that is not the point at issue. There is no idea of enunciating any new tactical theories, or experimenting on any novel method of employing troops. A weapon of great power can, without practically increasing the impedimenta of an army, be used in conjunction with the other arms, and a simple decision is required as to whether its adoption is desirable. Although many advantages might be secured by the permanent attachment of mitrailleuses to infantry and cavalry, it would seem best at first to organise them as a separate body at camps of instruction under specially trained officers. Whenever the three arms are exercising together detachments of two or more machine guns could then be temporarily attached to tactical units, and thus enable a theory of employment for them to be gradually worked out.

Increasing power of artillery.—The theory of artillery tactics as laid down in the preceding chapters is founded mainly on the experience of the Franco-German war of 1870–71. It must be, however, recognised that in that campaign the *massing* of guns was the result of the manner in which the general actions commenced, and did not arise from any preconceived tactical ideas.

The concentration of fire of a large group of batteries, and the effect of strict fire discipline, has never yet been seen on a large scale in the field. The guns, moreover, of the present day are far more powerful than those of 1870, and the destructive effects of the modern shrapnel shell have yet to be witnessed.

The experience of the Russo-Turkish campaign of 1876 is sometimes appealed to as showing that artillery is compara-

The effect of artillery against deeply made pits and sunken galleries cannot in any case be much, but in such cases infantry fire would be equally useless. No increase in the power of the gun or the weight of the projectile can enable the Arm to achieve impossibilities. In spite of all shortcomings, it may be pointed out that even in this campaign the attack of artillery when properly commanded was under the ordinary circumstances of battle invariably successful, *teste* the battles of Nicopolis and the Aladja Dagh.

If it be considered that the present artillery matériel has never yet been fairly tried in warfare, that every year increases in some manner its efficiency, that the modern theory of artillery tactics, or the mode of using the perfected equipment is of comparatively recent growth, and that the other arms are, from the very nature of their constituents, incapable of much more progress, it may be fairly deduced that the power of the artillery arm in the future will be even greater than it has been in the past.

The gun and rifle may be improved to almost any conceivable extent, but the agents which use them are subject to those common weaknesses of humanity over which a higher education or a stricter discipline has a comparatively limited sway. In contrasting the respective failings of the three arms, it cannot be contested that a higher efficiency can be more reasonably hoped for from that one which is least influenced by those human failings which are the natural lot of mankind.

No change in the rifle or carbine can materially affect the physique or mental characteristics of the infantry soldier in action, or alter the strength of a horse or the boldness of its rider. On the other hand, the effect of artillery depends mainly on its fire and method of employment. The latter can be improved by a higher and more practical discipline and drill, while the former may be essentially enhanced in effect by increasing the destructive effects of the gun.

Necessity of cover.—In order to carry out this result the agents who work the gun must be placed in a position in which their faculties are developed to the utmost by being relieved of those ordinary dangers which tend to distract the mind and strain the nerves. Protection, while serving the gun to an extent not now attainable, seems a first essential to future progress.

That additional cover of some kind is needed is evident from the data furnished us by the 1870 campaign. A study of the earlier battles of the war show that the loss in personnel—officers and men—and in horses was enormous, while that in matériel was absolutely insignificant.

The object to be protected is the men and their horses, while the danger to be warded off is the bullet of the infantry soldier, and the shrapnel fire of the enemy's artillery. It may be at once conceded that field artillery cannot under service conditions be rendered invulnerable, but still a great degree of safety will be afforded if the power of its most destructive enemies be checked.

Under certain conditions, notably when acting on the defensive, gun-pits or earthen épaulements can be used, but during the ordinary course of an engagement there will arise —especially in the case of an attacking force—many instances in which neither time nor opportunity allows of their erection.

Artificial cover.—With regard to cover for the men actually serving the gun, it has been often suggested that some sort of shield should be carried on the gun-carriage, that the axle-tree seats should be capable of conversion into a protecting mantlet, that the wheels should be plated with iron, &c. If the views already laid down as to the construction of guns and carriages be sound, it will be admitted that no extra weight, however small, can be carried with the gun itself. However well planned may be the construction of a mantlet so carried, it has the fatal defect of diminishing the mobility of batteries in order to provide for a contingency possibly two, extra carriages. Colonel Brackenbury suggests that shields should be made of wrought iron or soft steel, sufficiently strong to keep out the bullets of infantry and shrapnel shell, while they should be soft enough to let percussion shells pass through without cracking or splintering the plate. He also points out that the shields should be in sections small enough to be easily carried by the gunners, should be capable of being put together in a small space of time, and should be high enough to protect, even from long range infantry fire, an area sufficient to contain the gun and the men who work it.[1] There appears little doubt that shields of either thin solid steel, or preferably of ribs of steel, could be constructed to carry out the above views, and at the same time be conveyed easily if an extra waggon were attached to each battery. The form, size, weight, and mode of constructing and fitting together such a mantlet are matters of detai which must be left to be the subject of practical experiments.

To every novel suggestion there arises, of course, a certain amount of opposition. With reference to Colonel Brackenbury's proposal, it is stated that by using a shield a more conspicuous mark would be given for an enemy to aim at. In answer to this objection, it may be pointed out that whether an object is more or less clearly defined is entirely dependent upon how its immediate surroundings harmonise with the background. In some cases shields would render a gun detachment more easily seen, in others not. Shields, it must be remembered, would not be used in an artillery duel at long range, where time and opportunity would exist for utilising natural or excavating artificial cover. On the other hand, while exposed to infantry fire or assailed with shrapnel at short range, the exposed gun and its detachment is a mark of itself, so large and easy to hit that cover for it is an obvious advantage. Even in an artillery duel it is obvious that that side possesses an advantage which can, in a couple of minutes' time, protect itself from infantry and shrapnel fire, instead of either remaining totally exposed or taking half an hour to excavate cover.

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[1] 'Ironclad Field Artillery,' by Colonel Brackenbury. *Nineteenth Century*, July 1878.

Objection is also made that shields of a weight which can be carried into the field cannot keep out a common shell, and will, in fact, tend to burst in front of a gun detachment a shell which would be otherwise, perhaps, innocuous. To this a plea of 'non-proven' must be urged. The destruction of the personnel of a battery is effected almost entirely by the shrapnel fire of artillery; and even if common shell be, under the circumstances, a more effective missile, it must be remembered that the shield can at any moment be lowered to the ground, and thus any imaginary or real disadvantage be counteracted.

A system of shields and extra carriages would, of course, involve expense; but, on the other hand, the advantages may fairly be deemed to counterbalance this plea. The effect of the fire of artillery would be largely enhanced, it would be far more powerful to defend itself, and its action at short range against infantry would become positively annihilating under favourable conditions of ground. The shields, again, could be used under special circumstances to cover infantry, both in the attack and the defence. Whether artificial protection of this kind be used or not, it may be fairly questioned whether, when under a heavy fire, it would not be advisable to use a very small gun detachment of, say, three men at a time, and relieve them frequently from reserves lying down in rear of the flanks of the gun.

CHAPTER XVI.

THE ROYAL ARTILLERY.

Constitution of the Royal Regiment of Artillery—The separation of the field and garrison artillery—The subdivision of the present regiment.

THE necessity for establishing a permanent regiment which could supply the reliefs of artillerymen for foreign garrisons led to the formation of a Royal Regiment of Artillery, 2 companies strong, in 1716. In 1783, after the peace of Versailles, the strength was 3,302. One hundred years later the official peace establishment was 33,847.[1] During the first half of the present century the regiment was composed of a few troops of horse artillery, and a number of battalions divided into companies. The battalions had each a permanent head-quarter at Woolwich, and for the purpose of field service a certain number of light guns were horsed when occasion required.

In 1859 the various companies were formed into batteries of garrison and field artillery, and massed into brigades, which after the amalgamation with the Indian artillery in 1862 amounted to 29 in number.

In 1882 a fresh subdivision was made, and the Royal Regiment was divided into—

2 brigades of horse artillery.
4 brigades of field artillery.
11 territorial divisions of garrison artillery.

Each territorial division has allotted to it a first brigade of Royal Artillery, the remaining brigades being formed by the militia artillery regiments belonging to the military district.

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[1] Establishment for 1882-3. An interesting history of the birth and progress of the regiment is to be found in Lieut.-Colonel Duncan's *History of the Royal Artillery.*

An inspection of the following table will make clear the manner in which the batteries are grouped together and posted.

	Batteries	Guns	Horses	Officers and men
Horse Artillery.				
A Brigade { British Establishment .	8	48	618	1,049
A Brigade { Indian ,, .	5	30	885	814
B Brigade { British ,, .	8	48	672	1,133
B Brigade { Indian ,, .	5	30	885	814
Depôt (Staff, &c. R. E.), Woolwich	2	12	294	610
Total Royal Horse Artillery .	28	168	3,344	4,420
Field Artillery.				
1st Brigade { British Establishment	12	72	948	1,916
1st Brigade { Indian ,,	12	72	1,308	1,950
2nd Brigade { British ,,	9	54	720	1,473
2nd Brigade { Indian ,,	10	60	1,090	1,625
3rd Brigade { British ,,	9	54	696	1,428
3rd Brigade { Indian ,,	9	54	981	1,463
4th Brigade { British ,,	9	54	696	1,428
4th Brigade { Indian ,,	9	54	981	1,463
Riding-masters, &c. . . .	—	—	52	68
Total Field Artillery .	79	474	7,472	12,814
Garrison Artillery.				
1st Division { At Home .	5	—	—	1,287
1st Brigade { In India .	3	—	—	
Depôt—Newcastle { In Colonies	2	—	—	

		Batteries	Guns	Horses	Officers and men
Garrison Artillery (continued).					
Brought forward	. . .	19	—	—	2,560
3rd Division	At Home .	5	—	—	1,284
1st Brigade	In India .	3	—	—	
Depôt—Yarmouth	In Colonies	2	—	—	
4th Division	At Home .	5	—	—	1,284
1st Brigade	In India .	3	—	—	
Depôt—Dover	In Colonies	2	—	—	
5th Division	At Home .	4	—	—	1,248
1st Brigade	In India .	2	—	—	
Depôt—Woolwich	In Colonies	3	—	—	
6th Division	At Home .	5	—	—	1,289
1st Brigade	In India .	3	—	—	
Depôt—Portsmouth	In Colonies	2	—	—	
7th Division	At Home .	5	—	—	1,273
1st Brigade	In India .	2	—	—	
Depôt—Plymouth	In Colonies	3	—	—	
8th Division	At Home .	5	—	—	1,481
1st Brigade	In India .	3	—	—	
Depôt—Leith	In Colonies	2	—	—	
9th Division	At Home .	4	—	—	1,182
1st Brigade	In India .	2	—	—	
Depôt--Pembroke Dock	In Colonies	3	—	—	
10th Division	At Home .	4	—	—	1,591
1st Brigade	In India .	2	—	—	
Depot—Carrickfergus	In Colonies	4	—	—	
11th Division	At Home .	5	—	—	1,462
1st Brigade	In India .	2	—	—	
Depôt—Cork	In Colonies	3	—	—	
Total Garrison Batteries	.	107	—	—	14,654
Coast Brigade, District Staff, &c.	.	—	—	104	1,959
Grand Total of Royal Artillery	.	214	642	10,920	33,847

Command.—The following are the main features of a somewhat complex organisation for the purposes of the higher commands.

To the large military districts in England which are under the charge of a general officer, such as the Northern, Eastern, Western, Aldershot, and similar commands, are allotted a colonel of artillery, who with a brigade-major and staff is responsible for the administration of everything connected with the personnel and matériel of his district. The larger garrisons of Malta and Gibraltar are similarly treated.

The highest command is therefore distinctly *territorial*, and is unconnected with the brigade system.

In all fortified places the garrison batteries have each a portion of the armament and works allotted to them, and are by groups of two or more batteries put under the command of a lieutenant-colonel, who is responsible for the drill, discipline, and interior economy of the batteries, as well as the general condition of the armament. The lieutenant-colonels as a rule belong to the same brigade as the men under their charge, and exercise the ordinary powers of a commanding officer, but are distinctly subordinate to the colonel of the district, and refer to him in all matters which are not those purely of brigade interest. In the Horse and Field Brigades there are similar lieutenant-colonels, with commands over two or at most three batteries. A certain number of lieutenant-colonels, again, are also posted to small stations, and exercise their authority over the batteries which come under their charge irrespective of the brigade to which they belong.

Lieutenant-colonels in command are allowed a subaltern officer to act as adjutant.

At the depôt of each division of garrison artillery is a lieutenant-colonel in command of the auxiliary artillery, who, in addition to his other duties, has charge of the depôt, sees that recruits are put through their preliminary drills and obtain their proper equipment, and superintends the reof clothing and preliminary training, and after a short course of instruction are transferred to the garrison or field batteries allotted to the area from which they are procured. Batteries of the three branches of the regiment serving abroad are kept up to their establishment by drafts from the home batteries belonging to their own brigade or division. The batteries of the first army corps train recruits for themselves. This arrangement acts fairly well with the horse artillery and garrison batteries, for whom depôts really exist. In the case of the field artillery, however, there is no possibility of a recruit receiving instruction until he joins a service battery, and the majority of the service batteries at home are little more than training depôts to furnish men for those abroad.

According to the present arrangements, whenever large drafts are required for the field artillery in India the batteries at home are denuded of their trained men, and made very weak.

Past experience has proved the absolute necessity of having a depôt for field artillery, in which men can be taught the preliminary riding and driving, and there is but little doubt that training depôts for field artillery will be again formed.

Depôts of any kind are undoubted evils, but must exist to ensure the relief of men on duty abroad if the batteries which are at home are to be kept fit for service. The exigencies of the mounted branches of the artillery are so different from those of infantry or garrison artillery, that the depôt system will have to be made to work to suit them.

To have a small depôt to train men in home batteries or battalions in order to keep up the strength of those abroad works fairly well in dismounted branches of the service, owing to the ability of men to learn *in a short time the preliminary drills.*

To teach a man to ride and drive, however, requires at least six months, and some six months more to make him thoroughly efficient. Hence to use service batteries as training schools is to impair their efficiency seriously. It would appear advisable, when a field depôt is again formed, to devote it entirely, as formerly, to furnishing the foreign drafts, and allow the home batteries, on whatever strength they may be, to drill their own recruits. A slight demand for volunteers for foreign service could then be made on the batteries of the lower establishment without injury.

The duties of the *personnel* of mounted batteries has been fully explained, and it is apparent that the work of the officers entails much responsibility, and that to carry it out requires zeal, tactical knowledge, and aptitude. The men, in addition to the ordinary work of the cavalry soldier, have to take care of and use numerous and complicated stores, and perform all the special duties connected with the driving and serving of a field gun. A garrison artilleryman, on the other hand, has nothing to do with horses, but has, in addition to the usual duties of an infantry soldier, to work with fortress and siege guns, to shift heavy weights, mount and dismount ordnance, construct and repair batteries, and to perform the artillery duties connected with a fortress or applied in a siege. The officers should also know the details connected with the attack and defence of strong places, be conversant with the theory and practice of gunnery, and have a thorough acquaintance with the complicated matériel in their charge. The duties of the field and garrison branches of the artillery service are quite distinct, and the fact has been recognised in our service to the extent of keeping the non-commissioned officers and men of them separate. The alteration has been carried no further, and officers on a seniority list are indiscriminately posted to either arm.

Separation of the Field and Garrison Artillery.—The arguments in favour of a separation between the mounted and dismounted services being made are strong, and their sound-thorough training. The work of the officers was comparatively simple, and could be easily learnt.

The modern matériel is becoming every day more diverse and complicated, and it appears unquestionable that the incessant changes, alterations, and improvements make a greater demand on the intelligence, and necessitate a higher education of both officers and men. The men trained on a short service system are, as soon as they become really efficient, transferred to the reserves. The officers are the only body who have the opportunity of being familiarised with the necessary technical detail. On them the onus of training the men rests, and efficiency can best be secured by granting them stability in their profession.

Progress is the order of the day, and it is undoubted that both field and garrison artillery are increasing in importance, but while so doing they are, in respect of the work performed, drifting further apart. The two branches are as distinct as cavalry from infantry. The duties in each are so varied that it requires a special training of some years to make an officer thoroughly know his work; and owing to the incessant changes in matériel (especially in fortresses) it is advisable that an officer's service in either branch should be continuous.

'If it is conceded that artillery in future warfare has to fulfil a very important duty, and one which can be fulfilled by it alone both in the open field and before fortresses; if it is granted that the progressive development of the science of the manufacture of arms has given us guns more complicated and more delicate, and that a higher state of training in the manner of their use is necessary; and lastly, if it be allowed that the officers are the first who should have perfect cognizance of the reasons guiding the improvements in matériel, and that this can only be attained by a consistent working in one direction; then there remains but one thing to satisfy these requirements, which is—the separation of the officers of the field and garrison artillery.'[1]

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[1] *The Separation of the Artillery*, trans. by Major Clarke.

The present system is based on the idea that an artillery officer should be able to make himself acquainted with all branches of his profession. This versatility and aptitude for very different classes of work is undoubtedly possessed by some, but these few form but a small percentage of the regiment, and it is for the average mass, and not for the chosen few, that legislation must be made.

The existing organisation, again, does not work beneficially for the country. An officer may now spend thirty years of his life in the mounted branches of the service, and be suddenly placed in command of fortress and siege matériel, and have to superintend the training of men, and carry out in a very responsible position duties with which he is of necessity imperfectly acquainted.

The reverse case similarly may constantly occur, and cannot tend to the efficiency of the field artillery.

The life led in the field and garrison services is so different, that an officer enthusiastic and zealous in one can hardly be expected to take more than a lukewarm interest when suddenly shifted to the other. With regard to the junior officers, moreover, the result is unsatisfactory. Despite the theories as to *esprit de corps* pervading the regiment throughout, the fact remains that garrison work is unpopular. Inferiority of pay and bad stations in India, isolated detachments at out-stations in England and the colonies, are not prizes to look forward to.

The first attempt of a young and energetic officer is to get transferred to the mounted branches, and if not successful he is apt to become discontented, and perform the minimum of work which can be expected of him.

The best officers in the garrison artillery, those who thoroughly know and are interested in their work, are rarely content to remain in purely regimental appointments, but use mounted service that the average officer is attracted towards it, while the bulk of the best ones use the foot artillery as a temporary resting-place on the grounds of personal convenience.

To render more efficient a branch of the artillery which requires a high technical education, and to raise its status, demands a distinct separation of the corps of officers. The objections to forming the garrison artillery into a distinct arm are few in number.

There is, firstly, a disinclination to any great change in the organisation of a body which has done good work under existing conditions. The conservative spirit which resists every innovation is in its way useful in preventing ill-digested schemes being hastily carried out. It is urged, moreover, with some reason that an artillery officer is benefited by having a varied experience in the different classes of artillery work. An officer living a comparatively sedentary life in the garrison artillery is all the better for an occasional rousing up. The mounted branches are benefited by being at intervals reminded that there is a purely technical side to their profession, and that the care of horses and management of harness are not the sole criterion by which the value of an officer should be judged.

To this it may be answered that an average officer is more likely to do one class of work well, if he sticks to it, and that a large-minded interest in work can best be secured by a change in organisation.

It has been stated that service in the garrison artillery would be unpopular, and that there might be a difficulty in getting officers to elect for it in the first instance.

This can scarcely be admitted. A properly organised separation would raise the status of the garrison artillery, and from it the bulk of the technical appointments would be made. Slight additional inducements might be added, and the main great advantage would be secured, that an officer's position would be stable, and he might with some hope of correctness forecast his future life. A very able defence of the existing system was made in a lecture delivered some years ago, from which the following extracts are made.

'I apprehend that to confine one portion of your men of artillery science solely to the service of field artillery and tactics, and the other to that of siege and garrison artillery, even after a hard and fast line has been drawn where the service of guns of position ends and that of the lighter siege guns begins, is about as unphilosophical as to attempt to divide the science of astronomy or geology into departments.

'If we aspire to be scientific artillerists we must be prepared to grapple with our subject in all its phases.

'I deprecate any separation—for the sake of the field artillery, to whom such a change means less scientific knowledge, excluded as they would be from the chief part of the courses at the school of gunnery and the Royal Arsenal; for the sake of the garrison artillery, as they would become rather pedants than smart and enterprising soldiers; and for the sake of the artillery as a whole, inasmuch as, pure science being restricted to one section only, the general scientific average would be reduced.'

'An officer is liable to that common weakness of humanity—growing older—involving very often change of ideas, change of predilections and favourite pursuits. I apprehend that many officers would not care to have their horizon limited even to service in the horse artillery. . . A prejudiced man whose mind runs in one groove, and who regards the business of life, as it were, through a single eye-glass, is an anachronism in a corps claiming to be "scientific."'[1]

The arguments of Colonel Geary are based on the idea that we have a 'body of more than 1,000 officers of every grade and phase of intellect acting and reacting on each other for the attainment of one grand object.' The corps of artillery is assumed to be a unit of a size readily worked

It can scarcely be denied that the condition of the regiment prior to the Crimean war[1] was most unsatisfactory, and yet, according to the above theory, the reaction of the officers of the various branches on each other ought to have been far more effective than at the present day, when the regiment has more than doubled its size. Progress in efficiency has not been gained by vaunting a scientific knowledge which the corps, as a whole, does not possess, nor by any system of centralisation. It has been by breaking down the exclusive tendencies of the regiment, by assimilating it with the rest of the army, by teaching us first to be soldiers and then artillerymen, that the prominent excellence of the present personnel has been attained.

Over-centralisation has always proved an evil when the strain of war has been felt. However perfect may be the administration of the adjutant-general's department, it cannot deal effectually with a corps of over 30,000 men and a vast matériel dispersed in the four corners of the globe. To make the Royal Regiment a working army unit necessitates subdivision, and in carrying it out we shall only be following the practice of all other nations.

It may be fairly conceded that the arguments for keeping the Regiment as one body or dividing it up are about fairly balanced as long as the artillery is capable of being efficiently worked as a single mass. It must be remembered, however, that the Regiment now has attained a size without parallel in the military world, that its number of officers on one list is daily increasing, that promotion equal to that of the rest of the army cannot be kept up on a huge seniority list without a very large expenditure of money, that slow promotion means loss in efficiency, and that if an artillery regiment is in size an army it cannot effectively be assimilated in organisation and spirit with the other arms.

A fear is by some entertained that if the Regiment were divided there would be a loss of *esprit de corps*, and in its stead would arise a sentiment as to the particular subdivision in which a man served. There might, in consequence, arise a want of uniformity in system and carrying out of work.

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[1] *Vide* pamphlets on the organisation, armament, and deficiencies of the British Artillery, by Sir R. Gardiner.

On the other hand, it may be urged that, beyond the fact that each officer is an artilleryman, there can be no very great sentiment among a body of officers the majority of whom can, probably, have never even seen each other. No subdivision would affect that spirit which would naturally pervade all who serve in a distinct branch of the service, while a much stronger feeling of *camaraderie* would arise when an officer belongs to a force in which he will always serve, and with the members of which he is personally acquainted.

Those who advocate the subdivision of the Regiment do it with the idea that it will effect much in assimilating the artillery with the rest of the army, and thus break down that exclusive tendency and jealous feeling which has hitherto worked so prejudicially against the Regiment in the matter of giving officers commands and staff appointments.

Subdivision of the Regiment.—The possibility of carrying out a separation is, in some quarters, not admitted. The difficulty, no doubt, is great, but not insuperable, as has been clearly proved in the Prussian service. No division of officers can be made without reconstructing the regiment, and against taking this step there is a strong feeling among many of those who will be affected.

The garrison artillery cannot be made one unit while the horse and field form another, as the promotion of officers could not possibly be equalised.

The reconstruction of a regiment, enormous in size and gradually increasing in numbers, is a necessity, and however long delayed must some day be taken in hand. The main point to consider is the size of the unit of subdivision ; and, having settled on that, the office, supply, and staff organisafor the extra number of effective field officers in the artillery due to there being one to each battery. These are, however, matters of detail, and it would seem tolerably clear that a force of from twelve to sixteen batteries, according to the way in which the organisation is carried out, should form an artillery regiment. In the mounted services lieutenant-colonels would have the command of a divisional group of three or four batteries. In the garrison artillery the major's command would have to be increased in size.

The present brigade organisation is found to work without much friction,[1] and a further modification of it does not entail many administrative difficulties.

The method of relieving batteries, of supplying them with recruits and stores, and of arranging for the command of isolated batteries is a matter of organisation ; and there seems no reason why, in these matters, a decentralised system should not work as effectively as the present cumbrous one.

There appears no necessity to alter the present system materially in those points in which it works well. The full colonels might, irrespective of the brigade they nominally command, rest in charge of districts, and by means of a district office forward all necessary documents to head-quarters. The head-quarters of each brigade, unless the whole of the batteries were together at a station like Gibraltar or Malta, would be at a depôt in England in which recruits would be drilled for the batteries abroad. The depôt would, according to its strength, be commanded by a lieutenant-colonel, or a more junior officer, and at it would be preserved the usual records.

Regiments of artillery would be organised for the purpose of relief of batteries, drilling of recruits, promotion of officers, the forming of minor divisional commands, and the collection and care of individual records. The higher commands might, as is now the case, be essentially territorial, and be irrespective of regiments, while the supervision of the actual matériel, the strengths of the different batteries, their transfer from station to station, and a general code of discipline, would emanate from the adjutant-general's office.

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[1] Report of Adjutant-General, May 28, 1872.

It may be pointed out that a regimental organisation with depôts at certain brigade centres in England would work more efficiently in the training of recruits, and the filling up of batteries from peace to war strength, than can be effected under the present system. The service batteries abroad are now kept up to their strength by constant drafts from those at home, and the efficiency of the latter is sacrificed by their being turned virtually into a series of depôt training batteries.

In a service which is known to require at the very least one year, and under ordinary conditions two years to make an effective soldier, it is somewhat alarming to contemplate that in the event of a European war the whole of the horsed batteries (with the exception of those of the 1st Army Corps) would be composed of young recruits and untrained remounts.

It has been often stated that a large united corps has more influence than a series of regiments, and that the artillery arm would, in consequence, suffer by subdivision. This appears, however, to be a mistake. The very fact of the working unit, the battery, being small, and there being no higher one with any stability of form, necessarily lessens the influence of artillery on the battle-field. Few officers can read without feelings of regret the manner in which the artillery which had fought so brilliantly at Waterloo and throughout the Peninsular war were persistently ignored by the Great Duke. From 1815 till the Crimean campaign, which necessitated the use of a large artillery force as a principal arm, the state of the regiment was deplorable, and its influence in the military world small.

The increase in personnel, matériel, and efficiency is due in no way to the existence of a cumbrous machinery, but higher unit of organisation than a battery. A commencement has already been made by grouping batteries under a lieutenant-colonel; but this, to be effective, must be a stable arrangement, and one in which the command is permanent. At present the battery is the working unit, and all higher organisations tend towards a local or temporary command, in which the interest and influence of the grouped batteries is subordinated to the personal aggrandisement of the commander.

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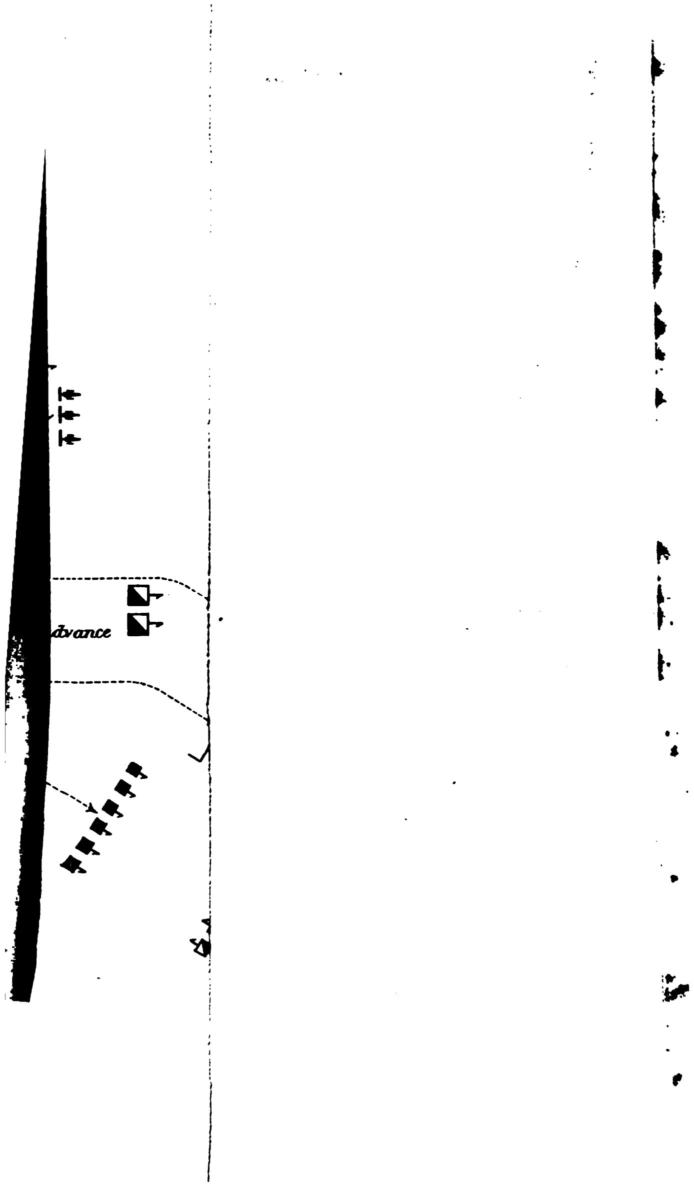

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